U. S. DEPARTMENT OF AGRICULTURE

DIVISION OF CHEMISTRY

BULLETIN No. 36

EXPERIMENTS

WITH

SUGAR BEETS

IN

1892

BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF CHEMISTRY,
Washington, D. C., December 31, 1892.

SIR: I have the honor to transmit, for your inspection and approval, the manuscript of Bulletin No. 36 of the Division of Chemistry, being a report on the experiments with sugar beets, conducted by your authority under my direction, during the season of 1892.

Pursuant to your directions, in accordance with my request the Entomologist, Dr. C. V. Riley, has supplied me with his report on the sugar-beet web worm, as prepared by him for the Annual Report of the U. S. Department of Agriculture for 1892, which is of special interest in connection with the present bulletin.

Respectfully,

H. W. WILEY,
Chemist.

Hon. J. M. RUSK,
Secretary of Agriculture.

EXPERIMENTS WITH SUGAR BEETS IN 1892.

Following in the line of the work of last year, sugar-beet seed of high grade imported from Europe was distributed to persons who had asked for samples. The distribution was made in the early spring of 1892. Four thousand pounds of seed were distributed in 8,159 packages, which were sent to 2,316 addresses, making an average of nearly four packages to each address. Each package was accompanied with printed instructions for preparing the soil, planting the seed, and cultivating the beets. Printed directions were also sent for taking samples for analysis, accompanied with shipping tags for franking the samples to the Department laboratory. Special duplicate shipping tags were sent to the persons who received seed in Nebraska, with the request to send duplicate samples to the experiment station at Lincoln for examination.

SUGAR-BEET SEED DISTRIBUTED.

The number of packages sent to each State and the number of persons to whom sent in each State and Territory are given in the following list:

State.	Packages distributed.	Persons receiving seed.	State.	Packages distributed.	Persons receiving seed.
Alabama	2	2	Montana	96	13
Arizona	11	2	Nebraska	730	93
Arkansas	64	63	Nevada	45	1
California	203	29	New Hampshire	3	3
Colorado	600	65	New Jersey	2	2
Connecticut	26	2	New Mexico	4	4
District of Columbia	30	1	New York	92	24
Florida	2	2	North Carolina	4	4
Georgia	2	2	North Dakota	186	42
Idaho	28	9	Ohio	1,103	335
Illinois	467	212	Oklahoma	8	8
Indiana	713	168	Oregon	112	24
Indian Territory	1	1	Pennsylvania	9	9
Iowa	598	204	South Carolina	13	4
Kansas	261	141	South Dakota	322	72
Kentucky	5	5	Tennessee	4	4
Louisiana	1	1	Texas	43	14
Maine	4	4	Utah	61	2
Maryland	6	6	Vermont	6	6
Massachusetts	6	3	Virginia	114	21
Michigan	579	178	Washington	191	46
Minnesota	614	232	West Virginia	39	7
Mississippi	3	3	Wisconsin	664	223
Missouri	60	23	Wyoming	31	7

The samples for analysis began to arrive at the laboratory in the latter part of September and continued to be received until the 20th of December, when further work in analysis of samples was suspended for the purpose of tabulating and classifying the results.

RESULTS OF ANALYSIS OF BEETS RECEIVED.

In the following tables are given the results of the analyses of the samples by counties and States, together with the average composition of the samples received from each State:

ARKANSAS.

Serial No.	Name of grower.	Post-office.	County.	Time of harvesting.	Yield per acre.	Date received.	No. of beets.	Average weight.	Total solids.	Sugar in beets.	Purity.	Sugar, yield per acre.
					Tons.	1892.		*Ounces.*	*Per cent.*	*Per cent.*		*Pounds.*
17090	Mrs. R. J. Cawood	Rogers	Benton	Nov. 3		Nov. 8	2	5	15.8	10.78	71.8	
16850	J. A. Harr	Fairmont	Prairie	Oct. 1		Oct. 10	1	17	14.9	8.11	57.3	
16851	do	do	do	Oct. 1		Oct. 10	1	13	15.1	9.32	64.9	
	Average							15	15.0	8.72	61.1	
	Average of State							12	15.3	9.41	64.7	

CALIFORNIA.

17204	William Shartel	Fort Bidwell	Modoc	Nov. 10		Nov. 22	2	19	21.9	16.14	77.6	
16842	J. W. Smith	San Luis Obispo	San Luis Obispo	Sept. 26	17.206	Oct. 4		11	17.6	12.77	76.4	3,028
16843	C. R. Callender	Los Berros	do	do	15.296	Oct. 4	1	18	19.0	15.15	83.9	3,509
17007	do	do	do	Oct. 21	15.246	Oct. 31	1	8	21.5	14.80	72.3	2,946
	Average				15.916			12	19.4	14.24	77.5	3,161
	Average of State				15.916			14	20.0	14.72	77.6	3,161

COLORADO.

17036	David Pirkins	Abbott	Arapahoe	Oct. 10		Oct. 31	2	42	25.0	16.74	70.4	
17026	Wm. Claussen	Newton	do	Oct. 27		Nov. 1	2	36	15.7	11.49	77.0	
	Average							39	20.4	14.12	73.7	
16839	G. F. Breninger	Table Rock	El Paso	Sept. 27	11.761	Oct. 3	2	12	19.0	14.07	78.0	2,331
16840	do	do	do	Sept. 27	12.197	Oct. 3	2	12	19.9	14.66	77.6	2,505
16935	do	do	do		12.196	Oct. 24	2	13	18.9	13.18	73.4	2,130
	Average				12.051			12	19.3	13.97	76.3	2,322
16833	Colorado Agricultural Experiment Station.	Fort Collins	Larimer	Sept. 27	7.620	Oct. 3	2	3	20.5	15.40	79.0	1,673
16834	do	do	do	Sept. 27	10.450	Oct. 3	2	8	19.5	14.78	79.7	2,222

16835	....do	....do	....do	Sept. 27	9.150	Oct. 3	2	9	21.9	16.63	80.0	2,198
16862	....do	....do	....do	Oct. 6	8.168	Oct. 12	2	9	20.1	16.13	84.5	2,008
16863	....do	....do	....do	Oct. 6	21.344	Oct. 12	2	20	19.6	15.16	81.4	4,755
16864	....do	....do	....do	Oct. 6	18.295	Oct. 12	2	26	18.1	14.42	83.9	3,996
16865	....do	....do	....do	Oct. 6	18.518	Oct. 12	2	18	20.0	16.50	86.9	4,792
16866	....do	....do	....do	Oct. 6	15.246	Oct. 12	2	9	22.5	19.37	90.6	4,830
16867	....do	....do	....do	Oct. 6	11.108	Oct. 12	2	11	22.0	18.59	89.0	3,317
16933	A. T. Gilkison	....do	....do	Oct. 15	21.395	Oct. 24	2	19	22.6	18.39	85.6	6,933
16934	....do	....do	....do	Oct. 15	.....	Oct. 24	2	25	19.9	16.05	84.9	.....
16956	Agricultural College Experiment Station.	....do	....do	Oct. 20	19.890	Oct. 25	2	11	20.2	16.52	86.1	2,797
17115	W. A. Gunn	Timnath	....do	Oct. 26	.....	Nov. 9	2	21	17.7	13.23	78.7	.....
17195	N. R. Faulkner	Loveland	....do	Nov. 1	.....	Nov. 21	2	19	19.5	15.02	81.1	.....
17196	....do	....do	....do	Nov. 1	.....	Nov. 21	2	19	17.7	13.38	79.6	.....
17210	A. T. Gilkison	Fort Collins	....do	Nov. 15	21.562	Nov. 25	2	18	22.0	17.98	86.0	6,020
17211	....do	....do	....do	Nov. 15	23.958	Nov. 25	2	20	23.6	19.13	85.4	7,063
17212	Fred Oldenburgh	Loveland	....do	.....	.....	Nov. 27	2	30	21.7	16.46	79.9	.....
17219	Colorado Agricultural Experiment Station.	Fort Collins	....do	Dec. 1	.....	Dec. 6	2	7	23.6	18.90	84.3	.....
	Average				15.439			16	20.7	16.42	83.5	4,046
16815	F. A. Huntley	Rocky Ford	Otero	Sept. 19	20.500	Sept. 24	2	15	20.4	15.86	81.8	4,801
16854	....do	....do	....do	Oct. 4	24.829	Oct. 10	2	19	16.9	12.35	76.9	4,256
16876	A. Nichols	....do	....do	Oct. 1	13.068	Oct. 13	1	18	18.3	12.99	74.7	2,287
16877	Lewis Swink	....do	....do	Oct. 3	21.780	Oct. 13	1	14	20.0	15.71	82.7	5,105
16878	....do	....do	....do	Oct. 7	23.022	Oct. 13	1	14	18.7	15.03	84.6	5,286
16879	G. W. Swink	....do	....do	Oct. 9	.....	Oct. 14	1	20	19.5	15.76	85.5	.....
16880	....do	....do	....do	Oct. 9	21.562	Oct. 14	1	14	24.0	20.40	89.4	7,098
16881	....do	....do	....do	Oct. 9	.....	Oct. 14	1	11	18.6	14.76	84.4	.....
16882	....do	....do	....do	Oct. 9	19.166	Oct. 14	1	18	22.2	18.02	86.0	5,359
16883	....do	....do	....do	Oct. 9	19.166	Oct. 14	1	12	21.9	17.82	86.4	5,324
16884	J. M. Biggs	La Junta	....do	Oct. 8	16.117	Oct. 14	2	14	24.4	20.28	87.8	5,183
16885	James McNean	....do	....do	Oct. 9	14.810	Oct. 14	2	15	20.4	15.87	82.3	3,492
16889	G. W. Swink	Rocky Ford	....do	Oct. 11	19.166	Oct. 15	1	9	19.1	14.41	80.2	3,998
16890	....do	....do	....do	Oct. 11	20.908	Oct. 15	1	11	17.5	13.76	83.7	4,349
16893	F. A. Huntley	....do	....do	Oct. 10	.....	Oct. 15	2	30	18.3	13.99	81.4	.....
16894	....do	....do	....do	Oct. 10	.....	Oct. 15	2	34	12.9	9.17	76.0	.....
16895	....do	....do	....do	Oct. 10	23,304	Oct. 15	2	23	16.8	12.65	79.3	4,213
16896	....do	....do	....do	Oct. 10	.....	Oct. 15	2	26	17.7	13.53	80.5	.....
16897	....do	....do	....do	Oct. 10	24.393	Oct. 15	2	25	18.6	15.09	85.4	5,673
16899	G. W. Swink	....do	....do	Oct. 14	15.682	Oct. 18	1	19	15.0	11.42	81.3	2,628
16909	J. L. Terwilliger	La Junta	....do	Oct. 10	.....	Oct. 19	4	33	15.8	10.64	72.5	.....
16910	G. W. Swink	Rocky Ford	....do	Oct. 14	13.068	Oct. 19	1	15	17.5	13.11	79.8	2,467
16911	....do	....do	....do	Oct. 14	13.939	Oct. 19	1	13	18.5	14.08	81.0	2,871
16912	....do	....do	....do	Oct. 14	20.909	Oct. 19	1	14	18.9	14.74	82.1	4,567
16913	....do	....do	....do	Oct. 14	18.295	Oct. 19	1	12	17.9	13.93	81.9	3,765
16914	....do	....do	....do	Oct. 14	15.682	Oct. 19	1	12	18.2	13.55	78.3	3,005
16915	....do	....do	....do	Oct. 15	18.294	Oct. 19	1	19	18.1	13.46	78.3	3,480
16916	Lane Brothers	....do	....do	Oct. 15	13.722	Oct. 19	1	13	20.0	16.09	84.7	3,378
16917	....do	....do	....do	Oct. 15	15.682	Oct. 19	1	14	20.3	16.44	85.3	3,971
16918	....do	....do	....do	Oct. 15	.....	Oct. 19	1	10	16.9	13.02	81.1	.....

Serial No.	Name of grower.	Post-office.	County.	Time of harvesting.	Yield per acre.	Date received.	No. of beets.	Average weight.	Total solids.	Sugar in beets.	Purity.	Sugar, yield per acre.
					Tons.	1892.		*Ounces.*	*Per cent.*	*Per cent.*		*Pounds.*
16931	A. Nichols	Rocky Ford	Otero	Oct. 15		Oct. 22	1	18	15.9	11.34	75.1	
16932	do	do	do	Oct. 15		Oct. 22	1	15	15.9	11.37	75.3	
16936	Dock Seaman	do	do	Oct. 19		Oct. 24	1	26	19.3	14.66	79.9	
16937	do	do	do	Oct. 19		Oct. 24	1	23	20.6	16.23	82.9	
16938	F. A. Huntley	do	do	Oct. 20	18.730	Oct. 24	2	15	22.2	17.93	85.0	5,151
16939	do	do	do	Oct. 20		Oct. 24	2	28	18.1	13.94	81.0	
16962	W. E. Anderson	do	do	Oct. 19		Oct. 26	1	14	18.5	15.08	85.1	
16988	Frank Day	La Junta	do	Oct. 15	17.500	Oct. 29	1	11	18.9	14.87	82.8	3,889
16989	M. F. Lindsley	do	do	Oct. 15	20.000	Oct. 29	1	22	17.5	13.53	81.3	4,884
16990	Adair & Son	Rocky Ford	do	Oct. 22		Oct. 29	1	12	19.0	13.95	77.2	
16991	do	do	do	Oct. 22		Oct. 29	1	19	18.6	13.74	77.7	
17039	J. C. Kain	do	do	Oct. 28		Nov. 3	2	19	19.6	14.10	75.7	
17040	George Nallows	Catlin	do	Oct. 25	6.098	Nov. 3	1	18	16.1	11.42	74.7	939
17048	Board of Trade	La Junta	do			Nov. 4	1	16	20.9	14.11	71.1	
17049	do	do	do			Nov. 4	1	18	20.7	14.90	75.7	
17050	Ole Sorenson	Fowler	do	Oct. 29		Nov. 4	1	23	19.5	15.02	81.1	
17078	J. W. Fertig	La Junta	do	Nov. 1		Nov. 7	1	20	17.1	12.07	74.3	
17079	S. H. Fertig	do	do	Nov. 2	18.000	Nov. 7	1	17	18.7	13.82	77.8	3,492
17080	J. B. Looper	do	do	Oct. 28		Nov. 7	1	19	20.0	15.67	82.5	
17081	L. C. Swink	Rocky Ford	do	Nov. 1		Nov. 7	1	18	18.4	15.27	87.3	
17082	John Fisher	do	do	Nov. 1	13.403	Nov. 7	1	14	20.2	16.25	84.7	3,319
17083	C. D. Williams	do	do	Nov. 1	23.653	Nov. 7	1	17	16.8	12.83	80.4	4,394
17093	Prof. F. A. Huntley	do	do	Nov. 3		Nov. 8	2	20	17.1	13.19	81.2	
17094	do	do	do	Nov. 3		Nov. 8	2	20	19.0	14.17	78.5	
17095	do	do	do	Nov. 3		Nov. 8	2	20	18.7	15.08	84.9	
17096	do	do	do	Nov. 3		Nov. 8	2	22	18.2	14.42	83.4	
17097	do	do	do	Nov. 3		Nov. 8	2	18	18.8	14.93	83.6	
17098	do	do	do	Nov. 3		Nov. 8	2	24	16.5	12.66	80.8	
17099	do	do	do	Nov. 3		Nov. 8	2	22	12.2	8.11	70.0	
17100	A. C. Comer	do	do	Nov. 3	8.712	Nov. 8	1	19	18.6	14.76	83.5	1,938
17114	Wm. Green	do	do	Oct. 15	15.159	Nov. 9	1	29	16.4	13.03	83.7	2,983
17128	L. Hartig	Fowler	do	Nov. 6	20.000	Nov. 12	1	11	16.5	12.14	77.5	3,396
17129	do	do	do	Nov. 6	20.000	Nov. 12	1	20	20.6	16.19	82.4	4,816
17130	Fred Janko	do	do	Oct. 30		Nov. 12	1	35	20.3	15.38	79.8	
17146	A. D. Best	Rocky Ford	do	Nov. 5	21.780	Nov. 14	1	17	21.6	15.02	73.2	4,326
17147	J. R. Moore	do	do	Nov. 6	15.681	Nov. 14	1	13	15.4	11.27	77.0	2,456
17151	B. N. Dye	do	do	Nov. 8		Nov. 15	1	26	18.5	14.53	82.6	
17152	Noris Dye	do	do	Nov. 8		Nov. 15	1	24	19.0	13.77	76.3	
17153	Edy Swink	do	do	Nov. 9	17.424	Nov. 15	1	24	19.7	15.83	84.6	4,213
17154	William Swink	do	do	Nov. 9	20.909	Nov. 15	1	23	19.5	15.80	85.3	5,085
17155	David Best	do	do	Nov. 10	20.037	Nov. 15	1	18	19.5	15.70	84.8	4,813
17156	C. H. Allen	La Junta	do	Nov. 10	16.503	Nov. 15	2	20	20.6	16.77	85.7	4,281
17157	W. B. Smith	Rocky Ford	do	Nov. 11	20.909	Nov. 16	1	15	21.8	16.14	77.9	4,742

17158	do	do	do	Nov. 11		Nov. 16	1	30	19.8	14.17	75.4	
17170	G. W. Swink	do	do	Nov. 12		Nov. 18	1	14	18.7	14.15	79.6	
17171	do	do	do	Nov. 12		Nov. 18	1	14	20.2	16.16	84.2	
17172	do	do	do	Nov. 12		Nov. 18	1	18	17.3	13.12	79.8	
17173	do	do	do	Nov. 12		Nov. 18	1	21	17.7	13.20	78.5	
17174	do	do	do	Nov. 12		Nov. 18	1	17	20.1	15.67	82.0	
17175	do	do	do	Nov. 12		Nov. 18	1	13	19.5	14.88	80.3	
17176	do	do	do	Nov. 12		Nov. 18	1	15	18.5	14.30	81.4	
17181	do	do	do	Nov. 13		Nov. 19	1	18	18.6	14.29	80.9	
17182	do	do	do	Nov. 14		Nov. 19	1	16	19.1	15.64	86.2	
17183	James Guthey	do	do	Nov. 14		Nov. 19	1	16	19.2	16.32	89.5	
17184	do	do	do	Nov. 15		Nov. 19	1	18	20.5	17.19	88.2	
17185	Derald Guthey	do	do	Nov. 14		Nov. 19	1	20	20.5	18.00	92.4	
17186	do	do	do	Nov. 14		Nov. 19	1	15	20.3	17.16	89.0	
17188	G. W. Swink	do	do	Nov. 16		Nov. 21	1	19	15.7	11.07	74.2	
17189	do	do	do	Nov. 16	24.393	Nov. 21	1	15	18.9	14.32	79.7	5,025
17190	do	do	do	Nov. 16	23.522	Nov. 21	1	20	19.4	15.39	83.5	5,457
17191	do	do	do	Nov. 16	20.037	Nov. 21	1	16	19.5	13.74	74.2	3,687
17192	do	do	do	Nov. 16	20.909	Nov. 21	1	16	20.0	15.81	83.2	4,964
17193	S. H. Pollock	do	do	Nov. 4		Nov. 21	1	16	22.5	18.32	85.2	
17194	do	do	do	Nov. 4		Nov. 21	1	15	21.8	17.82	86.1	
17216	G. W. Swink	do	do	Dec. 1		Dec. 5	1	14	20.2	15.52	80.9	
17218	do	do	do	Dec. 1	24.394	Dec. 6	1	15	21.4	16.54	81.4	5,923
	Average				18.583			18	18.9	14.61	81.4	4,146
17092	J. B. Traxler	Lamar	Prowers	Nov. 3	20.691	Nov. 8	1	16	14.9	10.96	77.4	3,029
16817	M. E. Bashor	Monte Vista	Rio Grande	Sept. 21	15.200	Sept. 26	1	13	16.9	14.08	87.1	3,365
16818	do	do	do	Sept. 21	15.200	Sept. 26	1	13	16.6	13.55	85.3	3,171
	Average				15.200			13	16.8	13.82	86.2	3,268
	Average of State				17.581			18	19.1	14.82	81.7	3,998

IDAHO.

17086	H. T. Eames	Almo	Cassia	Oct. 20		Nov. 7	2	34	19.5	14.65	79.1	

ILLINOIS.

Serial No.	Name of grower.	Post-office.	County.	Time of harvesting.	Yield per acre.	Date received.	No. of beets.	Average weight.	Total solids.	Sugar in beets.	Purity.	Sugar yield per acre.
					Tons.	1892.		*Ounces.*	*Per cent.*	*Per cent.*		*Pounds.*
17071	Frank D. Gardner	Champaign	Champaign	Nov. 4	10.454	Nov. 7	2	10	15.7	11.58	77.7	1,614
17072	do	do	do	Nov. 4	8.712	Nov. 7	2	9	16.4	12.52	80.4	1,584
17208	do	do	do	Nov. 19	7.950	Nov. 25	2	8	17.8	12.63	74.7	1,355
17209	do	do	do	Nov. 19	7.950	Nov. 25	2	6	20.6	15.86	81.0	1,844
	Average				8.767			8	17.6	13.15	78.5	1,599
16944	Eli C. Fisk	Havana	Mason	Oct. 21	12.132	Oct. 25	3	17	12.3	8.20	70.2	1,259
16945	do	do	do	Oct. 21	12.132	Oct. 25	1	24	12.7	8.89	73.7	1,436
16946	do	do	do	Oct. 21	12.132	Oct. 25	5	17	13.1	8.88	71.4	1,390
17029	do	do	do	Oct. 28	15.630	Nov. 1	4	9	13.2	7.80	62.2	1,369
17030	do	do	do	Oct. 28	12.197	Nov. 1	4	17	16.3	12.02	77.6	2,054
17031	do	do	do	Oct. 28	12.632	Nov. 1	4	19	15.2	10.81	74.9	1,847
17032	do	do	do	Oct. 28	8.712	Nov. 1	2	18	14.6	10.37	74.8	1,219
17033	do	do	do	Oct. 28	8.712	Nov. 1	2	16	15.6	10.52	71.0	1,174
17112	do	do	do	Nov. 5	9.148	Nov. 9	5	18	14.0	9.88	74.3	1,213
17113	do	do	do	Nov. 5	9.148	Nov. 9	5	18	13.8	9.33	71.2	1,098
17162	do	do	do	Nov. 5	10.890	Nov. 17	6	14	14.5	10.37	75.3	1,535
17163	do	do	do	Nov. 5	10.890	Nov. 17	6	19	14.3	10.05	73.9	1,459
	Average				11.196			17	14.1	9.77	72.9	1,421
17055	Howard Carl	Joliet	Will	Nov. 2	11.979	Nov. 5	2	14	17.6	13.29	79.5	2,286
17222	Floyd Smith	Harrison	Winnebago	Oct. 28	21.018	Dec. 10	2	11	18.4	13.61	77.9	4,023
	Average of State				11.246			15	15.3	10.93	75.2	1,653

INDIANA.

16816	W. A. Horrall, M. D	Washington	Daviess	Sept. 15		Sept. 24	2	23	11.9	7.65	66.9	
16837	R. D. Stotts	Euclid	do	Sept. 25	15.246	Oct. 3	2	11	17.5	10.98	66.1	1,997
	Average				15.246			17	14.7	9.32	66.5	1,997

17044	James M. Lewis	Vilas, Owen County. (*See* Owen County.)	Green	Oct. 31	12.415	Nov. 3	1	4	18.5	13.47	76.6	2,312
17200	Rev. Edward W. Fisher	Corydon	Harrison	Nov. 8		Nov. 21	3	6	16.0	10.54	69.4	
17201	do	do	do	Nov. 8		Nov. 21	3	7	15.7	10.51	70.4	
	Average							7	15.9	10.53	69.9	
17133	A. D. Ogborn	Newcastle	Henry	Oct. 25	16.335	Nov. 12	2	10	19.9	14.21	75.2	3,149
16800	Andrew Gietl	Rensselaer	Jasper	Sept. 2	16.300	Sept. 12	1	13	10.8	3.99	38.9	456
16801	do	do	do	Sept. 7	14.800	Sept. 12	1	7	15.7	10.55	70.7	1,992
16919	Nelson Morris (Chicago, Ill.)	Demotte	do	Oct. —	8.000	Oct. 19	30	8	16.0	12.18	80.1	1,408
16976	do	do	do	Oct. 24	8.000	Oct. 26	1	14	18.6	14.75	88.8	1,891
16977	do	do	do	Oct. 24	8.000	Oct. 26	1	10	17.4	13.77	83.2	1,654
16978	do	do	do	Oct. 24	8.000	Oct. 26	1	16	18.2	14.77	83.4	1,821
16979	do	do	do	Oct. 24	8.000	Oct. 26	1	17	16.4	12.89	82.7	1,541
	Average				10.157			12	16.2	11.85	75.4	1,538
16929	W. J. Mummah	Warsaw	Kosciusko	Oct. 12		Oct. 22	2	17	15.2	10.75	74.5	
16930	do	do	do	Oct. 12		Oct. 22	2	25	14.0	9.71	73.0	
17004	A. T. Cook	do	do	Oct. 24		Oct. 31	2	18	16.3	11.09	71.6	
	Average							20	15.2	10.52	73.0	
16820	James M. Lewis	Vilas (*See* Green Co.)	Owen	Sept. 22		Sept. 26	1	21	11.7	6.82	61.3	
17134	Alpha Langston	Dublin	Wayne	Oct. 28		Nov. 12	1	18	19.6	13.41	72.0	
	Average of State				11.510			14	16.1	11.23	72.5	18.22

IOWA.

17110	W. J. Grunewald	Blairstown	Benton	Oct. 22		Nov. 9	5	41	14.6	10.65	76.8	
17111	do	do	do	Oct. 22		Nov. 9	8	14	14.0	10.02	75.4	
	Average							28	14.3	10.34	76.1	
16987	Knud Bodholt	Newell	Buena Vista	Oct. 25		Oct. 29	1	42	15.8	12.04	80.2	
16841	Adam Scholl	Murray	Clarke	Oct. 1		Oct. 4	2	20	10.5	5.53	55.4	
16986	J. W. Stewart	Illyria	Fayette	Oct. 24	10.454	Oct. 29	2	18	16.2	12.71	82.6	1,980
16847	A. Snyder	Center Point	Linn	Oct. 5		Oct. 8	2	30	13.7	9.94	76.4	
16941	do	do	do	Oct. 18		Oct. 24	2	42	15.8	11.62	77.4	
	Average							36	14.8	10.78	76.9	

IOWA—Continued.

Serial No.	Name of grower.	Post-office.	County.	Time of harvesting.	Yield per acre.	Date received.	No. of beets.	Average weight.	Total solids.	Sugar in beets.	Purity.	Sugar, yield per acre.
					Tons.	1892.		*Ounces.*	*Per cent.*	*Per cent.*		*Pounds.*
16886	Eugene A. Hoge	James	Plymouth	Oct. 10	10.890	Oct. 14	2	36	13.3	10.19	80.7	1,616
17024	B. T. Seaman	Davenport	Scott	Oct. 25	18.000	Oct. 31	2	13	15.4	10.43	71.3	2,416
17025	do	do	do	Oct. 26	21.000	Oct. 31	2	18	16.1	10.91	71.3	2,948
	Average				19.500			15	15.8	10.67	71.3	2,682
17205	Ole Throndson	Callender	Webster	Nov. 7		Nov. 23	2	6	20.3	16.20	84.0	
	Average of State				15.086			24	15.1	10.93	76.2	2,240

KANSAS.

17214	H. H. Grover	Eldorado	Butler	Nov. 15		Dec. 3	2	20	19.8	12.58	66.9	
16900	Thos. B. Clark	Pfeifer	Ellis	Oct. 13		Oct. 18	2	61	14.1	9.36	70.9	
16807	P. W. Conyers	Garden City	Finney	Sept. 16	13.700	Sept. 21	1	11	15.8	9.57	68.1	1,611
16808	do	do	do	Sept. 16	13.700	Sept. 21	1	12	18.2	13.46	77.6	2,584
17005	do	do	do	Oct. 20		Oct. 31	2	34	15.5	10.80	73.3	
	Average				13.700			19	16.5	11.50	73.0	2,098
16860	Thomas Brown	Salem	Jewell	Oct. 8	12.197	Oct. 12	1	38	15.4	10.99	75.1	1,817
16861	do	do	do	Oct. 8	13.068	Oct. 12	1	37	16.0	11.57	76.1	2,075
	Average				12.638			37	15.7	11.28	75.6	1,946
16823	F. L. Frazey	Nickerson	Reno	Sept. 26	19.300	Sept. 29	1	36	15.7	11.17	74.2	2,887
16824	do	do	do	Sept. 26	18.000	Sept. 29	1	36	16.4	11.41	73.2	2,714
	Average				18.650			36	16.1	11.29	73.7	2,800
16827	T. K. Davis	Wherry	Rice	Sept. 27		Sept. 30	1	34	14.9	10.59	74.8	
16828	do	do	do	Sept. 27		Sept. 30	1	37	10.9	6.67	63.4	
16830	Joseph Hanschild	do	do	Sept. 28		Oct. 1	1	42	13.3	9.58	75.3	
16831	do	do	do	Sept. 28		Oct. 1	1	21	13.5	9.44	73.6	
	Average							34	13.2	9.07	71.8	
17089	Michael Streckfus	Salina	Saline	Nov. 1		Nov. 7	2	28	20.6	15.59	79.7	

16948	H. O. Peck	Wellington	Sumner	Oct. 18		Oct. 25	1	20	15.2	10.52	72.9	
16949	do	do	do	Oct. 18		Oct. 25	1	10	15.7	11.53	77.3	
16950	do	do	do	Oct. 20		Oct. 25	1	9	15.3	11.92	81.3	
16951	do	do	do	Oct. 20		Oct. 25	1	13	15.7	11.76	78.8	
	Average							13	15.5	11.44	77.7	
	Average of State				14.994			25	15.7	11.07	74.2	2,281

KENTUCKY.

16803	W. H. Lyon	Pulaski	Pulaski	Sept. 14	18.700	Sept. 21	2	12	12.8	9.79	80.5	2,659
16804	do	do	do	Sept. 14	16.300	Sept. 21	2	14	11.4	7.93	73.4	1,712
	Average				17.500			13	12.1	8.86	77.2	2,186

MICHIGAN.

16904	Henry Reinhard	Salzburg	Bay	Oct. 12		Oct. 19	1	37	13.7	10.36	80.8	
16905	William Reuther	do	do	Oct. 12		Oct. 19	1	73	10.2	5.42	57.1	
16906	do	do	do	Oct. 12		Oct. 19	2	33	14.3	10.29	76.1	
16965	T. H. McGraw and Co., per A. W. H. Lenders.	Portsmouth	do	Oct. 20	23.305	Oct. 26	2	17	17.5	13.58	81.1	4,628
16966	do	do	do	Oct. 20		Oct. 26	2	17	17.1	14.24	87.7	
16967	do	do	do	Oct. 20		Oct. 26	2	18	18.1	14.83	86.2	
16968	do	do	do	Oct. 20		Oct. 26	2	18	17.5	13.61	81.9	
16969	do	do	do	Oct. 21	23.958	Oct. 26	2	15	17.5	14.17	85.2	5,223
16970	do	do	do	Oct. 21	19.275	Oct. 26	2	18	16.3	13.36	86.2	4,009
16971	do	do	do	Oct. 21	20.255	Oct. 26	2	20	18.1	14.83	86.2	4,675
16972	do	do	do	Oct. 21	16.385	Oct. 26	2	16	19.1	15.59	85.9	3,962
16973	do	do	do	Oct. 21	20.038	Oct. 26	2	18	15.1	13.21	91.4	4,404
16974	do	do	do	Oct. 21	21.671	Oct. 26	2	16	18.1	14.64	85.1	4,872
16975	do	do	do	Oct. 21	15.464	Oct. 26	2	16	18.7	15.61	87.8	3,826
16999	do	do	do	Oct. 22	12.088	Oct. 29	2	14	18.8	14.50	81.2	2,567
17000	do	do	do	Oct. 22	11.543	Oct. 29	2	11	18.6	15.07	85.3	2,678
17001	do	do	do	Oct. 22	17.206	Oct. 29	2	18	16.9	13.60	84.8	3,579
17002	do	do	do	Oct. 22	13.504	Oct. 29	2	16	17.4	13.79	83.4	2,801
17003	do	do	do	Oct. 22	12.632	Oct. 29	2	13	18.1	13.95	81.1	2,579
17120	do	do	do	Oct. 22	13.177	Nov. 11	2	14	18.9	15.29	85.1	3,094
17121	do	do	do	Oct. 22	17.750	Nov. 11	2	15	20.7	15.62	79.5	3,980
17122	do	do	do	Oct. 22	11.761	Nov. 11	2	16	20.7	16.86	85.7	3,067
17123	do	do	do	Oct. 22	19.275	Nov. 11	2	15	21.3	18.13	89.6	5,651
17124	do	do	do	Oct. 24	15.464	Nov. 11	2	20	19.9	16.46	87.0	4,000
17125	do	do	do	Oct. 24	12.850	Nov. 11	2	12	19.5	15.76	85.0	3,107
17126	do	do	do	Oct. 24	17.642	Nov. 11	2	19	19.3	15.21	83.0	4,022
17127	do	do	do	Oct. 24	12.305	Nov. 11	2	15	19.5	16.07	86.7	3,096
	Average				16.550			20	17.8	14.22	84.1	3,801

MICHIGAN—Continued.

Serial No.	Name of grower.	Post-office.	County.	Time of harvesting.	Yield per acre.	Date received.	No. of beets.	Average weight.	Total solids.	Sugar in beets.	Purity.	Sugar, yield per acre.
					Tons.	1892.		*Ounces.*	*Per cent.*	*Per cent.*		*Pounds.*
17164	Elliston Warner	Quincy	Branch	Oct. 24	6.643	Nov. 17	1	11	15.6	11.03	74.4	984
17165	do	do	do	Oct. 24	8.657	Nov. 17	1	14	14.5	10.14	73.6	1,165
	Average				7.650			13	15.1	10.59	74.0	1,075
17069	Asa W. Slayton	Grand Rapids	Kent	Oct. 27	18.622	Nov. 7	2	19	17.4	13.35	80.7	3,620
17070	do	do	do	Oct. 27	20.745	Nov. 7	2	20	18.7	14.84	83.6	4,639
	Average				19.684			20	18.1	14.20	82.1	4,130
17159	Franz, Zoche	Washington	Macomb	Nov. 1		Nov. 16	2	18	17.8	13.09	77.4	
17067	J. M. Longyear	Marquette	Marquette	Oct. 28	24.611	Nov. 7	2	23	19.3	15.63	85.2	5,916
17068	do	do	do	Oct. 28	24.611	Nov. 7	2	34	20.1	16.48	86.3	6,360
	Average				24.611			29	19.7	16.06	85.8	6,138
17132	Geo. Minkel	Mecosta	Mecosta	Nov. 7		Nov. 12	2	23	18.1	14.69	85.4	
17041	E. A. Ellis	Bridgeport	Saginaw			Nov. 3	3	4	18.6	14.80	83.8	
	Average of State				16.720			19	17.8	14.11	83.4	3,796

MINNESOTA.

17059	Gilbert Guttersen	Lake Crystal	Blue Earth	Oct. 22		Nov. 5	2	26	16.4	10.85	69.6	
16952	W. D. Japs	Carver	Carver	Oct. 20		Oct. 25	2	20	15.5	11.54	78.4	
16953	do	do	do	Oct. 20		Oct. 25	2	25	15.6	12.19	82.2	
	Average							22	15.6	11.87	80.3	
16926	Carl Johnson	Chisago City	Chisago	Oct. 18		Oct. 22	2	20	17.3	13.13	79.8	
17225	C. B. Kittnedge	Glyndon	Clay	Oct. 10		Dec. 19	2	28	20.8	16.16	81.8	
17226	do	do	do	Oct. 10		Dec. 19	2	25	21.4	17.30	85.1	
	Average							26	21.1	16.73	83.5	

16812	F. C. Meade, jr.	Alexandria	Douglas	Sept. 20	6.900	Sept. 22	4	14	16.9	13.91	82.3	1,426
16855	do	do	do	Oct. 4	12.196	Oct. 10	4	13	17.5	14.40	86.6	2,767
	Average				9.548			14	17.2	14.16	84.5	2,097
16852	W. E. Poe	Cannon Falls	Goodhue	Oct. 6	15.246	Oct. 10	2	15	14.2	9.49	70.3	1,836
17144	J. E. Bosworth	Money Creek	Houston	Oct. 28	19.536	Nov. 14	1	43	16.9	12.31	76.7	3,329
17145	do	do	do	Oct. 28	16.932	Nov. 14	1	29	16.5	13.40	85.4	3,495
	Average				18.234			36	16.7	12.86	81.1	3,412
17060	C. W. Sargent	Woodstock	Pipestone	Oct. 20		Nov. 5	2	43	10.6	5.89	58.5	
16983	Herman Prahl	Renville	Renville	Oct. 25		Oct. 29	2	27	17.1	12.63	77.7	
17150	Hans Halverson	Tyrol	Stearns	Nov. 2		Nov. 15	2	47	15.6	10.42	70.3	
16887	Milo Camp	Morris	Stevens	Oct. 10	19.601	Oct. 14	1	12	17.5	13.30	80.0	3,763
16888	do	do	do	Oct. 10	19.601	Oct. 14	1	15	18.2	14.23	82.3	4,644
	Average				19.601			14	17.9	13.77	81.2	3,954
17109	Axel Kap	Eagle Bend	Todd	Oct. 6		Nov. 9	4	29	16.4	11.78	75.6	
16982	(*)	Lake City	Wabasha			Oct. 29	10	19	18.1	14.18	80.3	
16954	C. P. Lundstad	Lawndale	Wilkin	Oct. 20		Oct. 25	1	37	15.3	12.16	83.6	
16955	O. O. Varholdt	do	do	Oct. 20		Oct. 25	1	36	16.4	12.89	82.7	
	Average							37	15.9	12.53	83.2	
17045	B. M. Sacreiter	Utica	Winona	Oct. 20		Nov. 4	1	51	14.0	8.20	61.6	
17046	do	do	do	Oct. 20		Nov. 4	1	57	12.9	7.38	60.2	
	Average							54	13.5	7.79	60.9	
	Average of State				15.716			29	16.4	12.17	78.1	2,966

MISSOURI.

16998	W. T. Tummond	Kirksville	Adair			Oct. 29	2	47	13.9	8.94	67.7	
17187	Melchior Regh	Concordia	Lafayette			Nov. 21	11	18	12.9	7.24	5.91	
	Average of State							33	13.4	8.09	63.4	

* No name on description. The name Joseph Lobban appears on a copy of paper wrapped around the sample.

MONTANA.

Serial No.	Name of grower.	Post-office.	County.	Time of harvesting.	Yield per acre.	Date received.	No. of beets.	Average weight.	Total solids.	Sugar in beets.	Purity.	Sugar, yield per acre.
					Tons.	1892.		*Ounces.*	*Per cent.*	*Per cent.*		*Pounds.*
16925	John Rohner	Rohner	Lewis and Clarke	Oct. 13		Oct. 20	6	22	15.8	10.93	72.8	

NEBRASKA.

17062	F. McCoy	Alliance	Boxbutte	Oct. 27		Nov. 5	3	11	21.6	16.93	82.5	
17084	E. G. Bower	Butte	Boyd	Oct. 20	21.780	Nov. 7	1	30	18.2	14.54	84.1	4,805
17085	do	do	do	Oct. 20	21.780	Nov. 7	1	31	21.3	16.44	81.3	5,253
	Average				21.780			31	19.8	15.49	82.7	5,029
17118	H. A. Vedder	Sparks	Cherry	Nov. 4	5.445	Nov. 11	2	9	21.8	17.10	82.5	1,386
16813	Fremont Tribune	Fremont	Dodge	Sept. 17	20.000	Sept. 23	2	23	14.7	10.61	76.0	2,912
16814	do	do	do	Sept. 17	20.000	Sept. 23	2	20	13.2	9.50	75.7	2,596
17008	do	do	do			Oct. 31	2	28	18.6	11.12	62.8	
	Average				20.000			24	15.5	10.41	71.5	2,754
17131	Anton Krause	Ohiowa	Fillmore	Nov. 1	14.000	Nov. 12	1	33	18.3	13.85	79.7	2,789
16858	J. T. Green	Dustin	Holt	Oct. 7	10.018	Oct. 12	2	12	20.9	15.98	80.5	2,326
16859	do	do	do	Oct. 7	9.157	Oct. 12	2	11	21.5	17.76	86.9	2,551
	Average				9.588			12	21.2	16.87	83.7	2,439
17061	C. F. Haase	Norfolk	Madison	Oct. 22		Nov. 5	5	13	22.1	17.53	83.5	
16984	O. C. E. Robinson	Indianola	Red Willow	Oct. 13		Oct. 29	1	30	18.2	13.81	79.9	
16985	do	do	do	Oct. 13		Oct. 29	1	36	18.5	13.47	76.6	
	Average							33	18.4	13.64	78.3	
17102	D. F. Noyes	Falls City	Richardson	Nov. 4	17.424	Nov. 8	1	16	15.7	11.08	74.3	2,589
17103	do	do	do	Nov. 4	17.424	Nov. 8	1	16	16.7	12.61	79.4	3,150
	Average				17.424			16	16.2	11.85	76.9	2,870
	Average of State				15.703			21	18.8	14.15	79.3	3,036

NEVADA.

17135	R. H. McDowell	Reno	Washoe	Nov. 5	12.175	Nov. 12	8	17	17.9	14.38	84.6	2,674
17136	------do	------do	------do	Nov. 5	13.231	Nov. 12	8	15	19.6	15.88	85.3	3,236
17137	------do	------do	------do	Nov. 5	12.088	Nov. 12	8	17	18.9	15.61	86.9	2,959
17138	------do	------do	------do	Nov. 5	12.110	Nov. 12	16	11	19.0	16.11	88.7	3,122
17139	------do	------do	------do	Nov. 5	14.157	Nov. 12	9	12	19.7	16.88	90.2	3,893
17140	------do	------do	------do	Nov. 5	10.513	Nov. 12	8	7	19.0	16.75	90.3	2,867
17141	------do	------do	------do	Nov. 5	7.187	Nov. 12	8	8	18.7	15.85	89.2	1,834
17142	------do	------do	------do	Nov. 5	13.721	Nov. 12	8	13	19.0	16.11	88.7	3,537
17143	------do	------do	------do	Nov. 5	12.698	Nov. 12	8	13	18.6	15.94	90.2	3,294
	Average				11.987			13	18.9	15.92	83.4	3,046

NEW MEXICO.

16838	H. B. Ashenfelter	Maxwell City	Colfax	Sept. 27	8.276	Oct. 3	2	5	24.5	19.01	81.7	2,321
17042	------do	------do	------do	Oct. 28	10.890	Nov. 3	2	11	22.6	19.30	89.9	3,409
17043	------do	------do	------do	Oct. 28	6.098	Nov. 3	2	7	21.3	17.77	87.8	1,717
17087	------do	------do	------do	Nov. 1	5.009	Nov. 7	2	9	19.5	15.43	83.3	1,162
17088	------do	------do	------do	Nov. 1	7.187	Nov. 7	2	11	20.4	16.92	87.3	1,916
17107	------do	------do	------do	Nov. 3	12.197	Nov. 9	2	20	19.6	16.02	86.0	3,035
17108	------do	------do	------do	Nov. 3	8.276	Nov. 9	2	15	18.8	15.82	88.8	2,099
	Average				8.276			11	21.0	17.18	86.1	2,237
17177	Chas. W. Greene	Eddy	Lincoln			Nov. 19	4	21	15.0	10.31	72.3	
17178	E. S. Motten	------do	------do			Nov. 19	3	26	18.7	13.27	74.7	
17179	Geo. Blankenship	------do	------do			Nov. 19	3	36	16.9	12.22	76.1	
17180	G. O. Shield	------do	------do			Nov. 19	3	42	16.4	12.66	81.3	
	Average							31	16.8	12.11	75.9	
	Average of Territory				8.276			19	19.4	15.34	83.2	2,237

NEW YORK.

Serial No.	Name of grower.	Post-office.	County.	Time of harvesting.	Yield per acre.	Date received.	No. of beets.	Average weight.	Total solids.	Sugar in beets.	Purity.	Sugar, yield per acre.
					Tons.	1892.		*Ounces.*	*Per cent.*	*Per cent.*		*Pounds.*
17224	M. F. Pierson	Seneca Castle	Ontario	Nov. 5	19.602	Dec. 19	2	10	1.0	16.92	84.8	5,081
17065	E. S. Sterling	Eagle Harbor	Orleans	Oct. 20	.....	Nov. 7	2	31	18.6	15.03	85.1	.....
17223	Alphonse Friedrick	Baldwins, L. I.	Queens	Oct. 30	.....	Dec. 15	2	31	18.5	15.22	86.6	.....
16836	Daniel A. Lynn	Branchport	Yates	Oct. 6	11.102	Oct. 10	2	16	17.5	14.54	87.5	2,549
	Average of State				15.352			22	18.9	15.43	85.9	3,815

NORTH CAROLINA.

16825	C. N. Spowbour	Salem	Forsyth	Sept. 27	2.500	Sept. 30	2	4	12.2	8.69	75.0	295
16826	....do	....do	....do	Sept. 27	4.600	Sept. 30	2	4	13.5	9.29	71.7	554
	Average				3.550			4	12.9	8.99	73.4	425

NORTH DAKOTA.

17019	William A. McLean	Tower City	Cass	Oct. 13	.....	Oct. 31	2	28	18.2	13.53	78.2	.....
17073	....do	....do	....do	Oct. 13	.....	Nov. 7	2	28	22.6	16.45	76.6	.....
	Average				.....	.....	.....	28	20.4	14.99	77.4	.....
16819	George Oliver	Crary	Ramsey	Sept. 20	.....	Sept. 26	1	21	15.9	11.26	74.5	.....
16943	H. L. Van Ornum	Forman	Sargent	Oct. 18	.....	Oct. 24	2	20	16.4	11.69	75.0	.....
16907	Roger Allin	Grafton	Walsh	Oct. 12	22.216	Oct. 19	2	27	16.3	12.06	78.8	3,812
16908	....do	....do	....do	Oct. 12	22.651	Oct. 19	2	22	16.8	12.17	77.0	3,828
	Average				22.434			25	16.6	12.12	77.9	3,820
	Average of State				22.434			24	17.7	12.86	76.5	3,820

17197	H. G. Cartmell	Springfield	Clarke	Nov. 14		Nov. 21	3	17	14.9	9.33	65.9	
17198	Solomon Pence	Eagle City	do	Oct. 9		Nov. 21	3	27	14.8	10.69	76.0	
	Average							22	14.9	10.01	71.0	
17217	W. P. Wolf	Wilmington	Clinton	Nov. 18		Dec. 5	5	15	19.4	14.15	76.8	
16963	D. S. Gilmore	Wilson's Mills	Cuyahoga	Oct. 24		Oct. 26	1	21	13.8	10.17	77.5	
17036	Fred Whitcomb	Winameg	Fulton	Oct. 25	19.820	Nov. 2	2	17	16.7	12.69	80.0	36.34
17037	E. P. Ames	do	do	Oct. 24		Nov. 2	2	21	16.2	13.00	84.4	
	Average				19.820			19	16.5	12.85	82.2	36.34
16844	H. A. Andrews	Findlay	Hancock	Sept. 28	11.326	Oct. 5	2	18	15.7	10.74	72.0	15.81
16845	do	do	do	Sept. 28	6.752	Oct. 5	2	25	14.4	9.68	70.7	8.35
16920	Jacob Zeller	Mount Cory	do	Oct. 14		Oct. 20	3	17	16.8	12.21	76.5	
16921	do	do	do	Oct. 14		Oct. 20	3	18	17.8	14.02	84.0	
17010	Geo. W. Brown	McComb	do	Oct. 20		Oct. 31	2	41	18.5	13.47	76.7	
17038	Paul R. Bierdeman	Findlay	do	Oct. 31		Nov. 2	2	16	16.5	11.31	72.1	
17119	John Nelson	McComb	do	Nov. 2		Nov. 11	2	18	20.2	15.30	79.7	
17199	do	do	do	Nov. 17		Nov. 21	2	29	16.7	12.50	78.8	
	Average				9,039			23	16.8	12.42	77.8	12.08
16940	Fred Gehringer	Napoleon	Henry	Oct. 19		Oct. 24	2	27	15.1	10.93	76.2	
17011	A. J. Tompkins	Bellevue	Huron	Oct. 26		Oct. 31	2	35	17.0	13.56	83.9	
17160	F. E. Fitch	do	do	Oct. 29	13.939	Nov. 16	2	25	15.8	11.71	78.0	2,297
17161	do	do	do	Oct. 29		Nov. 16	2	37	18.0	13.22	77.3	
	Average				13.939			32	16.9	12.83	79.7	2,297
16964	Conrad Spanner	Ironton	Lawrence	Oct. 5		Oct. 26	2	15	13.8	8.53	65.1	
16853	R. C. Bradford	Dayton	Montgomery	Oct. 3		Oct. 10	4	11	14.3	10.60	78.1	
16857	Samuel Benner	Miamisburg	do	Oct. 10	17.142	Oct. 12	2	10	14.4	9.63	70.4	2,098
17012	Henry Beach	do	do	Oct. 26		Oct. 31	2	19	16.8	12.18	76.3	
17013	do	do	do	Aug. 9		Oct. 31	2	19	13.1	8.04	64.6	
17014	Samuel Benner	do	do	Oct. 25	18.513	Oct. 31	2	17	16.3	11.18	72.2	2,695
17015	Capt. D. W. Young	do	do	Aug. 9		Oct. 31	2	21	12.7	8.52	70.7	
17016	do	do	do	Sept. 10		Oct. 31	2	30	13.3	9.28	73.4	
17074	P. J. Meng	do	do	Oct. 29		Nov. 7	2	19	18.5	13.47	76.6	
	Average				17.878			18	14.9	10.36	73.2	2,397
16902	S. Curtis	Pagetown	Morrow	Oct. 3		Oct. 19	1	22	15.3	10.11	70.5	
16903	do	do	do	Oct. 3		Oct. 19	1	30	15.6	9.49	64.9	

Serial No.	Name of grower.	Post-office.	County.	Time of harvesting.	Yield per acre.	Date received.	No. of beets.	Average weight.	Total solids.	Sugar in beets.	Purity.	Sugar, yield per acre.
					Tons.	1892.		*Ounces.*	*Per cent.*	*Per cent.*		*Pounds.*
17206	S. Curtis	Pagetown	Morrow	Oct. 25	13.068	Nov. 23	2	15	19.7	14.91	79.7	2,802
17207	do	do	do	Oct. 26	12.850	Nov. 23	2	10	18.3	14.45	73.1	2,449
	Average				12.959			19	17.2	12.26	75.1	2,626
17075	Paul Weedmann	Paulding	Paulding	Oct. 22		Nov. 7	3	29	16.0	12.07	79.4	
17076	Alex. Harper	do	do	Oct. 24		Nov. 7	3	22	17.9	13.00	76.4	
17077	Sam'l Croven	do	do	Oct. 27	24.398	Nov. 7	3	25	15.9	10.83	71.7	3,421
	Average				24.398			25	16.6	11.97	75.8	3,421
17053	James W. Hays	Piketon	Pike	Oct. 26	24.829	Nov. 5	2	13	17.1	11.37	70.0	3,565
17054	do	do	do	Oct. 27	14.819	Nov. 5	2	7	16.1	10.77	70.4	2,026
	Average				19.870			10	16.6	11.08	70.2	2,796
17051	C. O. Hale	Ira	Summit	Oct. 25		Nov. 4	1	20	13.0	7.43	60.2	
17052	do	do	do	Oct. 25		Nov. 4	1	24	15.3	9.60	66.0	
	Average							22	14.2	8.52	63.1	
16957	H. M. White	Grand Rapids	Wood	Oct. 22	4.356	Oct. 25	2	7	18.2	15.10	87.3	1,036
17017	do	do	do	Oct. 25	6.970	Oct. 31	2	11	17.4	13.85	83.8	1,461
17018	do	do	do	Oct. 25		Oct. 31	2	24	17.2	13.26	81.2	
17213	G. W. Barnes	Weston	do	Nov. 1		Nov. 27	2	52	15.4	11.27	77.0	
	Average				5.663			24	17.1	13.37	82.3	1,240
	Average of State				14.521			21	16.1	11.62	76.0	2,300

OREGON.

17105	Stanley T. Woodruff	Philomath	Benton	Nov. 2		Nov. 9	2	10	17.2	13.13	80.3	
17106	Geo. R. Woodruff	do	do	Nov. 2	18.077	Nov. 9	2	6	14.2	10.38	77.0	2,607
	Average				18.077			8	15.7	11.76	78.7	2,607
17215	E. G. Haseltine	Mill City	Marion	Nov. 19		Dec. 3	3	15	19.6	14.51	77.9	

16821	Joseph M. Standley	Imbler	Union	Sept. 20		Sept. 28	1	17	20.0	17.82	93.8	
16822	do	do	do	Sept. 20		Sept. 28	1	24	18.5	14.21	80.8	
16871	Wm. Stoop	do	do	Oct. 6	*5.438	Oct. 13	1	17	20.9	15.16	77.1	1,147
16872	do	do	do	Oct. 6	5.438	Oct. 13	1	14	16.9	12.59	80.0	989
16873	Ed. Garn	do	do	Oct. 6	5.438	Oct. 13	1	22	22.3	16.13	76.1	1,204
	Average				5.438			19	19.7	15.18	81.1	1,113
	Average of State				8.598			17	18.7	14.24	80.2	1,487

* Yield as given on blank sent with beets.

PENNSYLVANIA.

16868	John A. McGranahan	Kennard	Mercer	Oct. 13	4.356	Oct. 13	4	11	16.6	13.49	86.5	918
16809	John W. Brant	Pine Hill	Somerset	Sept. 15		Sept. 21	4	14	12.8	8.00	65.0	
	Average of State				4.356			13	14.7	10.75	75.8	918

SOUTH DAKOTA.

17034	David G. Townsend	Plankington	Aurora	Oct. 24	20.175	Nov. 2	2	24	18.8	12.63	70.7	3,552
17035	do	do	do	Oct. 24	19.808	Nov. 2	2	25	17.4	11.64	70.4	2,932
	Average				19.992			25	18.1	12.14	70.6	3,092
16836	S. W. Narregang	Aberdeen	Brown	Sept. 21	20.255	Oct. 3	4	11	22.3	17.24	81.4	5,133
16942	do	do	do	Oct. 14	21.780	Oct. 24	5	12	22.4	16.92	75.0	4,989
16993	do	do	do	Oct. 15	16.988	Oct. 29	6	8	19.9	17.28	90.9	4,818
17202	C. I. Edson	do	do	Oct. 31	18.731	Nov. 22	2	17	19.1	14.45	79.6	3,889
17203	do	do	do	Oct. 31	18.513	Nov. 22	2	18	21.1	15.50	77.3	4,003
	Average				19.253			13	21.0	16.28	81.6	4,566
16806	John W. Kelley	Vandervoort	Clark	Sept. 13		Sept. 21	2	34	14.0	8.34	62.7	
16846	do	do	do	Sept. 28		Oct. 8	2	30	15.7	11.08	74.7	
	Average							32	14.9	9.71	68.7	
16805	Harvey Gunderson	Vermillion	Clay	Sept. 13		Sept. 21	2	25	11.6	7.85	71.2	

Serial No.	Name of grower.	Post-office.	County.	Time of harvesting.	Yield per acre.	Date received.	No. of beets.	Average weight.	Total solids.	Sugar in beets.	Purity.	Sugar, yield per acre.
					Tons.	1892.		*Ounces.*	*Per cent.*	*Per cent.*		*Pounds.*
16960	A. H. Wallace	Eckard	Fall River	Oct. 18	15.464	Oct. 26	2	10	20.2	13.97	72.7	2,836
16961	do	do	do	Oct. 18	12.197		2	12	22.7	17.76	82.3	3,218
	Average				13.830			11	21.5	15.87	77.5	3,027
16992	Geo. H. Bottcher	Highmore	Hyde	Oct. 14		Oct. 29	2	31	19.1	13.94	76.8	
17020	H. B. Young	do	do	Oct. 20		Oct. 31	1	31	16.6	11.40	72.3	
17021	John Sarvis	do	do	Oct. 15		Oct. 31	1	17	18.7	13.04	73.4	
17022	J. R. Smith	Holabird	do	Oct. 20		Oct. 31	1	13	16.5	10.98	70.1	
17023	John Melbourn	Highmore	do	Oct. 25		Oct. 31	1	18	18.6	13.65	77.3	
17056	C. E. Case	do	do	Oct. 6		Nov. 5	1	17	17.7	12.50	74.4	
	Average							21	17.9	11.59	74.0	
16928	John C. Todd	Iroquois	Kingsbury	Oct. 11		Oct. 22	2	18	16.4	10.39	66.7	
16980	E. Moscrift	Selina	Lincoln	Oct. 18	23.650	Oct. 27	2	39	13.9	9.12	65.2	2,540
16981	do	do	do	Oct. 18	21.560	Oct. 27	2	29	15.8	11.57	72.1	3,245
	Average				22.605			34	14.9	10.35	68.7	2,893
17101	Rev. George B. Reid	Leola	McPherson	Nov. 1	17.206	Nov. 8	5	10	19.2	14.77	81.0	3,634
16891	M. Bohlman	Vilas	Miner	Oct. 11	18.948	Oct. 15	2	16	17.1	12.07	75.2	3,107
16892	do	do	do	Oct. 10	13.503	Oct. 15	2	18	19.6	13.46	73.0	2,404
	Average				16.226			17	18.4	12.77	74.1	2,756
16927	Charles O'Neill	Springs	Potter	Oct. 15		Oct. 22	2	34	16.6	12.26	77.6	
17116	James Naylor, jr	Gettysburg	do	Nov. 1	16.335	Nov. 10	2	14	21.9	16.55	79.5	3,878
17117	do	do	do	Nov. 1	16.335	Nov. 10	2	14	20.9	14.98	75.5	33.36
	Average				16.335			21	19.8	14.59	77.5	3,607
17047	Alice Thomas	Doland	Spink	Oct. 26	6.534	Nov. 4	2	11	16.9	12.59	78.4	1,163
16994	G. R. Hayes	Norfolk	Sully	Oct. 18		Oct. 29	2	23	17.4	11.36	68.7	
16995	do	do	do	Oct. 18		Oct. 29	2	16	22.1	14.54	69.3	
	Average							19	19.8	12.95	69.0	
	Average of State				17.528			20	18.3	13.12	75.5	3,434

TENNESSEE.

16802	A. A. Coventry	Burreville	Morgan	Sept. 12	.....	Sept. 21	1	10	13.7	9.42	72.4	.....

VIRGINIA.

16874	A. F. Belcher	Burkeville	Nottoway	Oct. 11	8.712	Oct. 13	2	8	16.3	13.08	84.5	1,739
16875	do	do	do	Oct. 11	5.445	Oct. 13	2	8	17.2	13.09	80.1	922
16996	do	do	do	Oct. 27	8.712	Oct. 29	2	6	17.4	13.64	84.4	1,810
16997	do	do	do	Oct. 27	9.583	Oct. 29	2	12	16.2	12.30	79.9	1,700
	Average				8.113			9	16.8	13.11	82.1	1,543
16829	Richard McCoy	Riverton	Warren			Sept. 30	3	19	11.4	7.81	72.1	.....
16959	do	do	do			Oct. 26	2	20	16.3	11.46	73.9	.....
	Average							19	13.9	9.64	73.0	.....
	Average of State				8.113			12	15.8	11.95	79.6	1,543

WASHINGTON.

17220	John Peters	Waterville	Douglas			Dec. 7	1	21	19.2	12.50	68.6	.....
17221	H. T. Hudson	do	do	Oct. 26	13.939	Dec. 7	1	16	19.8	16.24	86.3	3,527
	Average				13.939			19	19.5	14.37	77.5	3,527
17027	John R. Reaves	Spokane	Spokane	Oct. 25	13.068	Nov. 1	1	12	23.2	15.78	71.6	2,666
17028	do	do	do	Oct. 25	13.068	Nov. 1	1	20	21.8	13.69	66.1	2,135
17091	E. H. Morrison	Fairfield	do	Oct. 25	17.860	Nov. 8	2	9	28.7	22.98	84.3	6,244
17166	John R. Reaves	Spokane	do	Nov. 11	17.424	Nov. 17	1	25	18.9	13.72	76.4	3,297
17167	do	do	do	Nov. 11	17.424	Nov. 17	1	28	20.9	14.70	74.0	3,419
	Average				15.769			19	22.7	16.17	75.0	3,552
17057	Henry Schütze	Calispell	Stevens	Oct. 22	15.572	Nov. 5	2	9	19.4	15.25	82.7	3,547
17058	do	do	do	Oct. 22	16.335	Nov. 5	2	11	18.8	14.88	83.3	3,656
	Average				15.954			10	19.1	15.07	83.0	3,602

WASHINGTON—Continued.

Serial No.	Name of grower.	Post-office.	County.	Time of harvesting.	Yield per acre.	Date received.	No. of beets.	Average weight.	Total solids.	Sugar in beets.	Purity.	Sugar, yield per acre.
					Tons.	1892.		*Ounces.*	*Per cent.*	*Per cent.*		*Pounds.*
16898	George Ruedy	Colfax	Whitman	Oct. 10		Oct. 17	2	8	17.7	13.38	80.5	
16947	M. Schuldhis	Uniontown	do	Oct. 16		Oct. 25	5	17	17.5	12.41	74.6	
17066	F. J. Mahoney	Tekoa	do	Oct. 15		Nov. 7	2	25	19.8	15.04	80.0	
17148	Conrad Tuschaff	Uniontown	do	Nov. 6		Nov. 15	5	34	18.5	11.72	70.5	
17149	do	do	do	Nov. 6	18.513	Nov. 15	5	34	16.0	10.96	72.1	2,640
	Average				18.513			24	17.7	12.70	75.5	2,640
	Average of State				14.320			18	19.9	14.52	76.8	3,113

WEST VIRGINIA.

17168	J. W. Bishop	Martinsburg	Berkeley			Nov. 18	5	17	18.2	11.87	68.7	
17169	do	do	do			Nov. 18	7	11	16.5	10.71	68.3	
	Average							14	17.4	11.29	68.5	

WISCONSIN.

16870	Henry Harbican	Big Patch	Grant	Oct. 9		Oct. 14	1	28	15.0	11.00	78.5	
16810	J. W. Whitehead	Twin Grove	Green	Sept. 18	13.700	Sept. 22	2	7	17.5	13.40	80.1	2,652
16811	do	do	do	Sept. 18	13.000	Sept. 22	2	9	17.0	11.94	73.9	2,067
	Average				13.350			8	17.3	12.67	77.0	2,360
16901	Egbert J. Cable	Markesan	Green Lake	Oct. 13		Oct. 19	2	10	13.7	8.62	69.2	
17104	Frank Williams	Highland	Iowa	Oct. 24		Nov. 8	2	64	16.1	11.11	72.6	
17009	J. W. Johnson	Mauston	Juneau	Oct. 27		Oct. 31	2	31	18.6	14.71	83.2	
16848	W. B. Bell	Dobbston	Langlade	Sept. 25	12.632	Oct. 8	1	18	18.1	13.06	75.9	2,261
16849	do	do	do	Sept. 25	15.464	Oct. 8	1	16	20.1	14.50	75.9	3,071
	Average				14.048			17	19.1	13.78	75.9	2,666

17063	Henry C. Koch	Manitowoc	Manitowoc	Oct. 26		Nov. 7	2	19	17.9	14.34	84.3	
17064	do	do	do	Oct. 26		Nov. 7	2	24	17.4	13.62	82.4	
	Average							21	17.7	13.98	83.4	
16958	Fred Pittman	Arkansaw	Pepin		18.513	Oct. 25	2	24	17.8	14.11	83.4	3,932
16869	David Scott	Rock Elm	Pierce	Oct. 6	23.522	Oct. 13	2	15	16.9	12.08	76.1	3,905
	Average of State				16.139			22	17.2	12.72	77.8	2,981

WYOMING.

16922	M. R. Johnston	Wheatland	Laramie	Oct. 14		Oct. 20	2	8	19.0	14.77	81.8	
16923	do	do	do	Oct. 14		Oct. 20	2	9	19.3	15.99	27.7	
16924	do	do	do	Oct. 14		Oct. 20	2	6	18.1	14.83	86.2	
	Average							8	18.8	15.20	85.2	

DATA OBTAINED FROM THE SEVERAL STATES.

Before proceeding to discuss the data in the preceding tables, attention should be called to the fact that in previous reports of this kind some dissatisfaction has been expressed in some States on account of the poor showing of the samples therefrom. In former reports attention has been particularly called to the fact that the data obtained by this method of experimentation are not wholly reliable and in all cases do not truly represent the capabilities of any locality for beet-sugar production. It is true that a large number of data received from a given State will indicate in a general way whether or not that State is capable of producing a good sugar beet, but where the number of data is limited it may be that the agricultural conditions under which the samples were produced were so poor, or the season so exceptional, as to prevent a fair judgment of the capabilities of the soil and climate. On the other hand, the culture which the samples received may have been so fine and the seasonal conditions so favorable as to produce a beet far above the average which could be produced in the whole State.

Again, the loss of moisture during transportation, or the failure of the farmers to send their beets in as soon as harvested, may tend to reduce the amount of water present in the beet and to raise correspondingly the quantity of sugar therein. Inasmuch as the analyses are made on the expressed juice, this would tend to show always an increased amount of sugar over that present naturally in the beets.

All these disturbing influences must be taken into consideration in judging the data which have been recorded. This has been said in general explanation so as to forestall any criticisms which may be made of the data obtained.

To illustrate more particularly what is meant, attention is called to the instance, say, of Colorado and Montana. From the State of Colorado one hundred and twenty-three samples were received for analysis and from the State of Montana only one sample. Any comparison, therefore, between the average results of the two States would be simply absurd. While one hundred and twenty-three samples from Colorado, showing, as they do, fine possibilities of sugar-beet culture, indicate that the State of Colorado is capable of producing beets of high quality, the single sample from Montana, whether it proved exceptionally poor or exceptionally fine, could have been no criterion by which the capabilities of the State for beet-sugar production could be judged.

In connection with the tentative results which have been obtained by this kind of work should be taken the characteristics of the soil and climate of each locality, and by putting the two together a fairly good idea can be formed of the possibilities of beet-sugar production.

The reader should carefully bear the above explanation in mind, both in looking over the data in the tables and in reading the remarks thereon which follow.

REMARKS ON ANALYSES.

Arkansas.—Number of samples received, 3. The average size of the samples was 12 ounces, and the content of sugar in the beet 9.41. Although Arkansas is farther south than the general experience indicates as a locality for the successful growth of sugar beets, the fact that sugar beets can be grown not only in Arkansas, but in other Southern States, shows the capability of the wide distribution of this plant. There is probably not a State in the Union where sugar beets can not be grown successfully, at least for cattle feeding, and where they can not be grown with a fair content of sugar. It is true that with beets of the richness indicated above it would not be profitable to manufacture sugar. In other words, it would not be profitable in competition with beets of higher quality, yet large quantities of sugar could be made, even from such beets.

California.—Although California is the most promising State for the manufacture of beet sugar in the United States, in so far as the present determination has extended, yet the number of samples received therefrom at the laboratory was very small. Three factories were in operation in California during the past season, viz, the old factory at Alvarado and the factories at Watsonville and Chino. The amount of sugar made at each one, as indicated by the returns filed in the Office of Internal Revenue, is as follows:

	1892.	1891.
	Pounds.	*Pounds.*
Alameda	1,473,500	1,094,900
Western *	9,316,835	4,340,556
Chino Valley	7,903,541	2,051,400

* Up to December 18, 1892, at which time there was still two weeks' work, which would bring the total up to near 10,000,000 pounds.

The beets which were received from the State were of fair size and showed a high content of sugar. In this connection, however, it must be remarked that the beets were long in transit and must have lost a considerable quantity of water. They were somewhat wilted and shriveled in appearance when received. Such beets, of course, would indicate a higher percentage of sugar than they would really contain in a fresh state, and the same remark may be applied to the beets shipped any distance by mail or to beets which have been exposed any considerable time to the air after harvesting, before the determination of the sugar.

Colorado.—Colorado furnished a large number of samples, showing a great interest among the farmers of that State in the culture of the sugar beet. In regard to the content of sugar shown by these samples, the remark made with reference to California must also be made here, viz, that the amount of sugar indicated on analysis is higher than that actually present at the time of harvesting, on account of the loss of water during transportation. Nevertheless, the beets which were received from Colorado must be considered as in every way typical. The average size was just about what a typical sugar beet should have, and the content of sugar and the purity of the juice were in every sense satisfactory.

The experience which has been gained in Colorado and other central Western States situated in the high plateaus of the Rocky Mountains, is such as to lead to the greatest encouragement to the beet-sugar industry in those regions. Especially where irrigation can be practiced, and the climate thus be absolutely controlled, the results from all those localities are of the highest significance. Irrigated land is of course of much higher value, other things being equal, than that which is not irrigated, and hence would be suited to the growth of a crop which would yield high returns. If irrigated land be worth from $100 to $200 per acre it should be planted in a crop which would yield a net profit of from $10 to $20. It is difficult to see how an ordinary cereal crop could be made to yield regularly so high an interest on the investment. In the case of sugar beets it would be easy to secure a crop with an average net profit of the amount mentioned above. The study, therefore, of the results from Colorado is of unusual interest for the reasons above stated.

Idaho.—Only one sample was received from this State. This sample was very much overgrown, the beets being quite double the size of typical beets. Nevertheless the percentage of sugar was very fair although the purity was very low. The beets came, as might be expected, in a badly wilted condition.

Illinois.—The samples from Illinois, eighteen in number, indicate a beet of only fair quality but of very nearly typical size. Evidently, if we regard the conditions of culture as about the same in the different localities, the soil and climate of Illinois are not so well suited to the production of a rich sugar beet as the soil and climate of Colorado.

Indiana.—The soil and climate of Indiana and Illinois are very similar in quality and the number of samples received from each State was the same, viz, 18. The Indiana samples, however, are slightly richer in sugar than those from Illinois. The samples from both States, however, came in a shriveled condition, showing that they had been harvested for some time before being sent in for examination; hence the usual corrections must be made for this cause.

Iowa.—Eleven samples were received from this State, having about the composition of those of Illinois and Indiana.

In general it must be said that such results as are indicated in these tables must be taken for what they are worth and not as typical of what each State can do.

The larger the number of samples, the greater the value which can be placed upon the data. For instance, Colorado with one hundred and twenty-three samples would give much more reliable data than Iowa with eleven samples, especially when we consider that in the report of last year Iowa showed a much larger number of samples and the results were so much better than those indicated by the data of the present season.

Kansas.—Kansas has a peculiarly hot and dry climate, not suited to the conditions of typical beet growth. Nevertheless even in Kansas sugar beets of high sugar content can be produced, as has been indicated by experiments in former years. Eighteen samples were received from this State and these samples were considerably overgrown, being almost one-half larger than typical beets. The average percentage of sugar in the samples received from the State is fairly good, as indicated in the tables.

Kentucky.—Two samples were received from Kentucky and these were of poor quality. It would be extremely unjust to judge of the possibilities of beet production in Kentucky from the samples received.

Michigan.—Thirty-seven samples from the State of Michigan showed an average of rather full size, but with a fine content of sugar. The general results of all the experiments indicate that Michigan is a State peculiarly well suited to the production of rich sugar beets.

Minnesota.—Twenty-two samples from the State of Minnesota showed that the average size of the beets was very much above the normal, while the sugar content was fairly good considering the overgrown condition of the beets examined.

Missouri.—Only two samples were received from this State and these were double the normal size. It would be wholly unjust to judge of the possibilities of Missouri for beet growing by two such samples. There is every reason to believe that the northern part of the State especially is well suited to the growth of beets of high grade.

Montana.—The single sample from Montana (somewhat overgrown) is quite insufficient to give any idea of the possibilities of the State. Montana, being one of the States of high altitude, would doubtless, in proper circumstances, be able to grow beets as rich as those produced in Colorado.

Nebraska.—Two beet-sugar factories have been in operation in Nebraska during the year, viz, at Grand Island and Norfolk. The number

of pounds of sugar made, as indicated by the returns on file in the Office of Internal Revenue, is as follows:

	1892.	1891.
Grand Island	2,110,100	1,415,800
Norfolk	1,698,400	1,218,700

Fifteen samples only were received for analysis in the laboratory, and these were somewhat overgrown, but contained a very high percentage of sugar. The experience of four years has now demonstrated the fact that beets of high sugar content can be grown in Nebraska, and with proper agricultural conditions with a fair tonnage per acre. The study of the data obtained at the experimental station of the department in Nebraska will be given in another part of this report.

Nevada.—Nine samples from the State of Nevada indicated a beet of rather small size, but with a phenomenally large content of sugar. Nevada, with proper irrigation, will doubtless be one of those States in which the culture of the sugar beet will flourish.

New Mexico.—Eleven samples from the Territory of New Mexico showed a beet rather above the average size, but with an extremely high content of sugar. New Mexico also belongs to the region of high plateaus, which under proper agricultural conditions can be made to produce a phenomenally rich beet.

New York.—Only four samples were received from the State of New York. These showed a beet rather above the average size, but with a very high content of sugar.

The capabilities of the culture of the sugar beet are well presented by comparing the data on the State of New York with those from the high plateaus of the Rocky Mountain region. No two climates could be more unlike than those of the Rocky Mountain plateaus and the State of New York, and yet the character of the beets produced in each locality is about the same. Attention has been called in these reports to the advantages of the northern part of New York for beet culture, and while it would be unfair to judge of the capabilities of the State on the analysis of four samples, yet they are sufficient to indicate the character of the beets which can be grown.

North Carolina.—Only two samples were received from this State, and therefore no judgment could be formed of a definite nature concerning it. The samples were very small in size and had a very low content of sugar.

North Dakota.—Six samples only were received from this State, showing beets rather overgrown, but with a fair content of sugar.

Ohio.—Forty-two samples were received from the State of Ohio, showing an average beet above the normal size and with a fair content of sugar. More interest has been shown in Ohio during the past season in regard to the sugar beet than ever before, and attention is called to

the fact that especially in the northern part there are vast areas suitable to the culture of beets, and the climate of northern Ohio is certainly favorable to the production of a high-grade beet.

Oregon.—Eight samples from the State of Oregon showed a beet of average size and fine sugar content, suitable to the economical and profitable production of sugar. Oregon evidently shares with the rest of the Pacific coast those special advantages for beet culture which have already been demonstrated practically in the State of California.

Pennsylvania.—Only two samples were received from this State. They were rather small in size and showed only a moderate content of sugar.

South Dakota.—Thirty samples from the State of South Dakota showed an average beet above the normal size and with a fair content of sugar. South Dakota has so nearly the same advantages for the production of beets as Nebraska that the remarks applied to one State may also be justly applied to the other. The only danger to be feared in beet production in South Dakota would be the advent of an early frost, which would not give sufficient time for the farmer to properly harvest and protect his crop.

Tennessee.—One sample from Tennessee shows a beet below the average size and with a low content of sugar.

Virginia.—Six samples from the State of Virginia showed an average beet rather below the normal in size, but with a fair content of sugar.

Washington.—Fourteen samples from the State of Washington showed a beet of full normal size and with a very high content of sugar. Washington, in common with the rest of the Pacific slope, shows especial advantages for beet culture.

West Virginia.—Two samples from the State of West Virginia show a beet almost of normal size and with a fair content of sugar.

Wisconsin.—The number of samples received from Wisconsin during the past season was much less than usual, due to the fact that the Department did not have the valuable coöperation of the Wisconsin State Experiment Station. The State, however, has been so fully exploited in previous experiments that a continuation of them is hardly necessary to show the great capabilities of it for beet sugar production. Twelve samples of beets showed an average considerably above the normal in weight and with a fair percentage of sugar.

Wyoming.—From the State of Wyoming three samples were received. They were only about half normal size, but extremely rich in sugar. Wyoming possesses the general advantages which have been indicated for Colorado, and on the irrigated lands of the State sugar beets of typical size and high sugar content can be easily grown. The elevated plateaus of Wyoming, when properly irrigated, would doubtless prove more profitable for beet culture than for any other crop.

Utah.—The Territory of Utah has high plateaus capable of irrigation which are well suited to beet culture. One beet-sugar factory is oper-

ated in the Territory, located at Lehi. It is the only factory which at this date (December 31, 1892) has made a full report of its operations to the Commissioner of Internal Revenue. This report follows:

The Utah Sugar Company.

[Season of 1892–'93.]

Date of commencing operations (commenced on sirup of previous year, operating five days), September 1, 1892.

Date of commencing operations on beets of this year, September 26, 1892.

Date of final closing, November 19, 1892.

Actual time that the whole of the machinery was in operation, thirty days and four hours.

Running time, not including the five days first mentioned, thirty-seven days.

Number of employés at factory proper, 110.

Quantity of beets consumed, 9,816 tons.

Acres of beets consumed, 1,090.

Yield in tons of beets per acre, 9.

Average per cent of sugar extracted from beets, 7½.

Average per cent of sucrose in beets, 11.

Total amount of sugar made, 1,473,500 pounds.

Sugar made per ton of beets, 150 pounds.

Sugar made per acre of beets, 1,350 pounds.

Molasses left over from season of 1892, 70,603.72 gallons.

Estimated sugar in molasses left over for further treatment, 183,958 pounds.

Residue of molasses from season of 1891 worked over in 1892, held in tanks, 50,063 gallons.

In averaging the per centum of sugar extracted from beets, the sugar extracted from last year's molasses is included, as the same amount of sugar is left over this season in process of manufacture.

Sugar extracted from last year's molasses, 131,800 pounds.

WORK DONE AT THE DEPARTMENT STATION AT SCHUYLER, NEBR.

The work at the Department station at Schuyler during the present year was carried on for the purpose of determining the best methods for the production of the beets and for a comparative trial of the different standard varieties of beets grown from imported seed.

The rotation work of the station was also inaugurated by the growing of different crops in such a way as to bring once in four years each plat of ground into culture with beets. Wheat and oats were taken as the best crops for beginning the rotation, and some very interesting rotation experiments were made of autumnal-grown wheat, which yielded large crops and at remunerative rates. The experiments in growing wheat sown in the autumn were of particular interest in that locality, where the greater part of the wheat is sown in the spring. It is the intention to prosecute the rotation experiments not only in such a way as to prepare the land thoroughly for the growth of beets, but also incidentally to illustrate the best crops for the locality and the best methods for the culture thereof.

In special work of this kind there is a tendency to overlook the importance of this incidental work. In the growth of sugar beets for com-

mercial purposes there is perhaps no agricultural problem of greater importance than the proper preparation of the land and the proper rotation of crops in order to secure a periodic growth of beets, not only of high tonnage but rich in sugar. More particular attention in succeeding years will be given to this branch of the work.

The importance of this work is especially true for an agricultural community such as that in which the station is situated. It is a community in which the fertilization of the soil is a problem which has entirely escaped the attention of the farmer. Blessed with a virgin soil of the greatest richness the farmer has continued heretofore to harvest his large crops without concerning himself respecting the continual drain which he is making upon his soil.

It has been said in Europe that a beet-sugar factory in any locality is a true agricultural experiment station, and as a result of establishing these factories every branch of agriculture has been immensely benefited. Other crops, such as cereals, potatoes, and grasses, have been made to yield far greater returns as the result of the experiment lessons taught by the beet fields. It is hoped that some such instruction as this may result from the conduct of a beet-sugar experiment station organized upon the plan of the one at Schuyler. In the organization of the station and in the original plan for its operation this point was held constantly in view, and as long as the station remains under its present management it will be the purpose to carry out its work on the lines originally laid down, modifying them from time to time as the exigencies of the circumstances may require and as the experience gained by the work may indicate.

The work of the station last year was under the personal supervision of Mr. Walter Maxwell, who was assisted in the chemical work by Mr. T. C. Trescot. The detailed statement of the work at the station will be found in the report of Mr. Maxwell, which is made a part of this bulletin.

EXPERIMENTS IN THE PRODUCTION OF BEET SEED.

The work of the season commenced during the last week of March. The weather was so severe up to that time as to preclude any possibility of successful investigation. The silos, in which the beets designed for propagation of seed had been preserved through the winter, were opened on the 26th of March. On the 5th of April the work of analyzing the mother beets commenced.

Each of the beets was subjected to separate analysis, a conical piece being bored out of each one of them diagonally in such a way as to secure a sufficient amount of pulp for chemical examination without interfering in any way with the vitality of the beet. Each variety of beets was examined separately. These beets, as indicated in the last report, were selected by physical appearance during the harvest of the preceding year. Those beets which had perfect form and were of the

full weight were selected and preserved. At the time the beets were preserved a sufficient number was taken to form an idea of the character of the whole lot, and this sample was subjected to analysis.

Another selected portion, representing an average sample, was carefully weighed before being deposited in the silo. On the opening of the silos these weighed portions were reweighed, thus showing the actual gain or loss of weight in the beets during their confinement under ground.

Another average sample similar to the one analyzed the preceding fall was also subjected to analysis, thus determining the loss of sugar during the winter.

These two sets of data, viz, the loss of sugar and the gain or loss of weight, together form the data for the corrections to be applied to the analysis of the mother beets so as to express the data arising therefrom in figures which would have been obtained had the analyses been made at the time the mother beets were siloed. The reason for this kind of work is at once apparent.

The object of the analysis of the mother beets is to classify them for the production of seed of different grades. It is therefore necessary to know just what the original condition of the mother beet was in order to know its tendency to produce offspring of a given kind. It would manifestly be unfair to gauge the beets for sugar-producing purposes from the condition in which they are found in the spring, inasmuch as the beet would tend to produce the same character of seed as would have been indicated by its original analysis at the time of storing. Any incidental deterioration during the winter would simply effect the content of sugar and not the potency of the parent to reproduce a seed of a given strength.

The dimensions of the silos in which the beets were preserved, the methods of their structure, and other data connected with the storage of the beets during the winter will be found in the appended report.

The mother beets were analyzed at the rate of four hundred and fifty a day, and only those which were analyzed during the day were taken out of the silo and prepared for analysis.

In regard to the classification of the beets, the following résumé may be given: Each beet was numbered on analysis, and at the close of the day's work they were sorted into classes according to the results of the analytical data. Three grades were made of the beets of each variety.

The poorest grade, numbered 2, consisted of all those beets which, reduced to the condition in which they were at the time of storing, contained from 12 to 16 per cent of sugar in the juice. Of the whole number of mother beets examined 3,567 were included in this classification.

The No. 1 grade consisted of those beets which on the same basis contained from 16 to 18 per cent of sugar. Of the whole number of mothers analyzed 830 fell in this grade.

The highest grade consisted of those beets of extra quality containing 18 per cent of sugar and above. Of this grade a total of thirty-eight was obtained.

The actual loss of sugar in the mother beets from the time of storing, October 15, 1891, to the opening of the silos in April, 1892, was 2.85 per cent, as determined on the average of each variety. On the analysis, therefore, of the mother beet 2.85 per cent was added to the content of sugar actually obtained in order to restore it to its normal composition at the time of harvest. In this way the classification above made was obtained.

The vitality of the mother beets was almost perfect, not more than 20 out of 4,435 failed to grow and produce seed. The cultivation received was simply keeping the weeds down and the ground loose by hand hoeing, of which the crop received three cultivations.

The harvesting of the seed commenced on August 5 on some parts, which were prematurely ripened by the hot weather. The harvesting was finished on the 24th of August, and, as a whole, resulted in the production of seed of fine appearance, great vitality, and excellent yield. The total area under cultivation for seed was 98.3 square rods. The total yield of seed was 595 pounds, or at the rate of 968 pounds per acre. At 15 cents per pound the value of the seed per acre would therefore be $145.20.

The interesting part of the seed-production work will come during the next season, when the home-grown seed will be compared directly with that of foreign importation. It is confidently believed that the seed produced in the locality will have superior qualities in respect of vitality and prepotency over the imported seeds.

At the present time no organized effort has been made in this country to grow high-grade beet seed on a large scale to supply the demands for home consumption. During the past season about 15,000 acres of beets were cultivated in this country. At 15 pounds per acre the amount of seed required to plant this area was 225,000 pounds, and, at 15 cents a pound, the value of this seed was $33,750. Already the item of beet seed is one of considerable importance, and in common practice it may be said that the expense of beet seed for each acre, when properly planted, will be about $2. A great increase in the acreage, therefore, sown to beets would soon create a demand for high-grade seed of home production, which would justify a reasonable amount of capital in entering into the business on a large scale.

EXPERIMENTS IN BEET CULTURE.

The preparation for the crop of 1892 was commenced in October, 1891. The land which was to be planted in beets on the following spring was at that time carefully plowed, and subsoiled to a depth of 16 to 18 inches. The surface of the soil was thus exposed to weathering during the winter. The preparation of the seed bed was commenced on the 24th of April.

The plats designed for the reception of the beet seed were pulverized with a disk harrow to a depth of 4 to 5 inches, and afterwards an ordinary 2-horse harrow was drawn twice over them. After hoeing, the plats were rolled and the seed was then put in with a drill to a depth of from one-half to one inch, and the ground rolled a second time.

The varieties of beets planted were Vilmorin's Improved, Dippe's Kleinwanzlebener, Desprez, Lemaire, Kleinwanzlebener Elite, and Original Kleinwanzlebener. The Knauer variety of seed which was planted in 1890 was not planted in the season of 1892 because the beet seeds ordered from Europe did not reach the station in time. Before planting the seed a test was made of its vitality in a germinating frame. The vitality of the different varieties of seed ranged from 36 to 96 per cent. Some of the seeds had become moist in transportation across the ocean, and the low vitality is perhaps due to this cause.

The first planting was made on the 30th of April and the planting was continued until the 4th of June at various intervals. Details of the planting and cultural work of the season will be found in the report following.

One of the most interesting parts of the work carried on, from a practical point of view, was the determination of the actual expense of growing, harvesting, and delivering to a distance of 3 miles one acre of beets. Accurate account was taken of every hour's work done on this plat, which was charged for at full rates for labor and team. No charge, however, was made for the general supervision.

The ravages of the caterpillar, which will be referred to in detail later on, unfortunately cut the yield of this test acre down to a very low point, and, as will be seen by the details of the work, the actual expense incurred was a little greater than the actual cash received for the beets. This, however, would not have turned out in this way except for the damage done to the crop by the caterpillar mentioned.

The yield of this acre, which was taken for the experiment, was considerably lower than that of any other plat, but had it been only equal to that of the other plats, there would have been a handsome profit.

Specimens of the injurious insect were submitted to the Entomologist for identification. The methods of treatment suggested by him for destroying the insects were also tried.

In general, it may be said that the agricultural work for the season of 1892 was fairly satisfactory in spite of the many adverse conditions which were encountered. The production of a crop averaging nearly 16 tons per acre is certainly satisfactory, especially when, as shown by the details of the work, the production of each ton of beets above 13 per acre is almost clear profit. There is no reason to doubt the ability of good farmers to produce a crop of equal tonnage when growing beets for the factory.

It is true that farmers in some cases may have been misled by statements concerning the profitableness of beet growing. Extreme care

is exercised in the published reports of this Department to avoid mistakes of this kind. On the other hand, discouraging data are not reported by the Department, as has been alleged in some quarters, for the sake of discouraging the industry, but simply for the purpose of presenting to the farmer the actual facts in the case. There is no business, agricultural or otherwise, which can be conducted with uniform success. Failures are always possible and always probable, and the fact that some people fail in a business is no argument whatever against the possibility of others being successful therein.

It is the object of the Department in publishing these cultural data to lay before the farmer who desires such information accurate data on which to base the estimates of his work. It is therefore the purpose of the report not only to be scientifically accurate, but also to present practical information which can be at once utilized by the farmer who does not have the time or the means to make such experiments for himself.

ANALYTICAL DATA.

The work of analyzing the beets grown during the season of 1892 was commenced on the 1st of September. The condition of the crop on September 1 was hardly such as to warrant the beginning of the analytical work. It was far from maturity and in many cases had not recovered from the insect ravages of the summer.

In the publication of the analytical data a departure has been made from the course pursued the last year, in omitting altogether the individual analyses and all analyses by groups of tens or otherwise. The analytical data which are of value are those which are the means of the analyses of any given variety at any given time. Inasmuch as the tabular statements of individual analyses take up an immense amount of space, without subserving any further practical result than to secure a permanent record of the analyses, it has been thought best in the interest of the economy of space to suppress them. Each individual analysis made, however, remains on record on the books of the Department, so that it will not be lost in case it is desired to consult any particular series of results.

The method of examination was based essentially upon that used last year. At each period of examination each plat of beets was gone over in regular order and a definite number selected for analysis. These selections were made in such a way as to represent accurately the average condition of the crop. The whole number of plats was thus gone over and the results tabulated before a second examination was commenced. An effort was made to go over the whole of the plats each week, so as to get a complete weekly record of the progress of the crop toward maturity, and also of the period at which it reached its maximum content of sugar, both in the juice and per acre, and finally toward the end of the season to determine the deterioration to which the crop would be subjected on being left too long in the ground or being sent too tardily to the factory.

Twice during the analytical examinations a measured area of each plat was harvested, so that the average weight of the beets could be determined and the average yield per acre at that time be calculated. The results show that upon the whole there was little variation in the actual content of sugar per acre. In other words, that as the content of sugar in the juice increased the weight of the beet diminished, and *vice versa.*

The beets of last year, as well as of this, were uniformly smaller than the average best sugar beet should be, being only a little over half the size which should be expected of the normal beet. In other words, the beets averaged only a little over 225 grams in weight, whereas a beet averaging 500 grams in weight would, from an agricultural point of view, be far more desirable, while as respects its content of sugar it might show a little less in the juice, but still it would be sufficiently rich for all practical purposes.

A glance at the weights of the beets in the different seasons should be supplemented by a study of the meteorological data, because the varying weight of the average beet was largely a factor of warm and moist weather and dry and cold weather; the dry and cold weather tending to diminish the weight of the beet, and the warm, moist weather tending to increase it.

It is seen, therefore, that there was a minimum in the weight of the beet at the beginning of the season, and that the first maximum was reached along about the end of September, followed by a second minimum near the middle of October and a second maximum near the 1st of November.

In regard to the sugar content of the juice, we find that it was lowest at the middle of November and reached a maximum about the middle of October, showing a gradual decrease in richness until the 18th of November, when the analytical work ceased.

In respect of the purity of the juice, we find it following closely the sucrose content of the juice, showing a minimum purity about the 15th of September and a maximum near the middle of October.

The practical result of this is that the most profitable time for the farmer to harvest his beets in the locality in which these experiments were made, and the most profitable time for the factory to purchase them is about the middle of October. Practically, of course, it is impossible for all of the beets to be delivered at a factory at this time, and there must be some loss both from too early harvesting and too late harvesting, and from keeping the beets in silo until they can be manufactured.

The analytical data gave also some valuable information in regard to the maximum yield of sugar per acre; in other words, the actual sugar produced per acre by each variety at the period of its maximum sugar content.

The Vilmorin Improved variety produced 3,900 pounds per acre.

The Desprez variety produced 4,368 pounds per acre.

The Lemaire variety produced 4,614 pounds per acre.

Dippe's Kleinwanzlebener variety produced 4,800 pounds per acre.

The Kleinwanzlebener Elite variety produced 5,120 pounds per acre.

The Original Kleinwanzlebener variety produced 5,989 pounds per acre.

The difference in the amount of sugar per acre consists chiefly in the tonnage yielded by each variety and not so much in the varying content of sugar. Nevertheless the Original Kleinwanzlebener not only had the largest tonnage per acre, viz, 18.6, but also the highest content of sugar in the juice, viz, 16.1.

The means for all six varieties were as follows:

Mean tonnage per acre		15.8
Mean percentage of sugar in juice		15.1
Mean yield of sugar per acre	pounds..	4,800

The mistake should not be made of supposing that the amount of sugar per acre mentioned above is what would be obtained in merchantable form. This represents the actual yield of sugar per acre as grown in the field.

The mean purity of the juice for all the varieties was 79.6.

Had the beets been manufactured by the best approved methods the yield of sugar per acre would have been, approximately, 3,200 pounds.

The comparison of the analytical data obtained during the seasons of 1891 and 1892 shows that in 1891 the mean yield of all the varieties per acre was 21.7 tons, containing 6,060 pounds of sugar; and for 1892 the mean yield of all varieties was 15.8 tons per acre, containing 4,800 pounds of sugar.

Interesting observations were also made on the effect of different methods of preserving beets as respecting their content of sugar. The loss in weight which beets undergo, when transmitted through the mails, has already been noticed. In a special experiment of this kind it was found in a case of a certain number of beets sent from the station at Schuyler to the Department laboratory in Washington, that the loss in weight was accompanied by a corresponding increase in the percentage of sugar in the juice. In other words, when beets are carefully wrapped as indicated in the directions for transmitting to the Department and sent through the mails they suffer no appreciable loss of sugar within the three or four days necessary for their transmission. On the other hand, it has been shown that when beets were harvested and exposed to the sunlight at a time of rather high temperature not only was there a greater loss in weight in four days amounting to as much as 37 per cent, but that also there was an actual loss in the amount of sugar contained in the beets. This loss amounted to about 29 per cent in the time mentioned. When the beets were kept in a shed, the loss in weight was also considerable, due to evaporation, but the loss in sugar was considerably less. When, however, beets were

kept in cold storage or in moist earth the temperature of which was below 40°, it was found that there was practically no loss of sugar during a period of over twenty days. There was a slight loss of moisture in the beets kept in cold storage and a corresponding increase in the amount of sugar in the juice.

In the beets kept in the moist, cold earth at a temperature below 40° but not low enough to freeze them, there was neither loss of weight nor sugar.

The conclusion to be drawn from these interesting experiments is of a practical nature, namely, that in the preservation of beets an attempt should be made to keep them covered with moist earth and at a temperature which should not be allowed, if possible, to rise above 40°.

The idea presents itself here in a very forcible way whether or not it would be profitable for beet-sugar factories to provide cold-storage cellars for the preservation of their beets, in which the temperature could be so regulated as not to be allowed to rise above 40° or fall below 32°. In such a cold-storage cellar the beets could be kept probably for two or three months without any appreciable loss of sugar.

The loss of sugar in beets after they are harvested is doubtless due to the vital processes going on in the organism of the beet. In other words the beet is living off of itself, no longer being connected with the earth and air in such a way as to draw any nourishment from either source. This vitality of the beet is almost completely checked when it is kept at a low temperature and in a dark place, but it is stimulated to the highest extent when it is exposed to a high temperature and a bright light. In other words, the exclusion of heat and light from the organism of the beet will tend to arrest almost completely all the vital action and thus preserve the sugar which nature has stored in the beet as a source of food supply in secondary growth.

The general result of the season's work has shown, first, the effect of the season on the crop, showing as the work has done this year that in the seasonal condition of 1892, even with more favorable culture than was received in 1891, the crop was much less per acre. In the second place, the season's work has shown the danger which may be encountered in this country from an entirely new pest in the form of a caterpillar which is liable to attack the crop in the middle of summer. In the third place, the work has shown practically the best method of storing the beets in order to preserve their sugar content at its maximum. In the fourth place, the method of producing a high-grade beet seed has been thoroughly worked out and the seed produced in this way preserved for future propagation. In the fifth place, the actual cost of producing an acre of beets, when labor is paid for by the day, has been worked out in its minutest detail and the numbers given representing the expense in dollars and cents, may be taken to indicate the maximum cost of the production of an acre of sugar beets by the method indicated. Although the experiments showed, in the given

case, that the actual cost of the beets in money was greater than the actual cash received therefor, yet it was shown that upon the whole station, had it been cultivated in the same way, there would have been a net profit of over $10 per acre.

These reliable data can not fail to be of the utmost interest to the farmer, enabling him to thoroughly foresee the probable cost of the production and the probable income which he will receive from a crop of sugar beets.

REPORT OF ASSISTANT IN CHARGE.

The details of the experimental work at this station are given in the report of Mr. Walter Maxwell, assistant in charge, which is as follows:

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF CHEMISTRY,
Washington, D. C.

SIR: I beg to submit to you the second annual report of the work of the U. S. Department of Agriculture sugar beet experiment station at Schuyler, Nebr., in the year 1892.

Very respectfully,

WALTER MAXWELL,
Assistant in charge.

Prof. H. W. WILEY,
Director of Station.

The work of the season of 1892, at the sugar beet experiment station, began the last week of March.

On March 26 the silos, in which the beets intended for propagation uses had been preserved through the winter, were examined.

April 5, the work of analyzing the beets which had been preserved in the silos was begun. Mr. T. C. Trescot assisted in the analytical work.

The mode of selection for the mother beets was by examining all of each variety grown at the time of harvesting and taking out from the whole every individual beet whose properties came within the standard of conditions required.

The standard conditions were that the beet should be of the form typical of each variety and of the size approved for propagation purposes. The beet should have a more or less tapering and elongated form, according to the type of the variety, and one leading tap root, which is a graduation of the body of the beet to a point, and and the body of the beet should be free from coarse side roots and inequalities of surface. The foliage system should rest closely upon the body of the beet and without a long and coarse-fleshed neck. In respect of the size, no beet was selected which weighed less than 500 grams or more than 800 grams.

The silos in which the mother beets were preserved were constructed upon a plan embracing precautions against the great fluctuations and lowness of temperature which prevail in this part of Nebraska, and also provision for sufficient ventilation and air replacement in the silos. Each silo was 18 feet long, 5 feet deep, and 6 feet broad at the surface, the breadth tapering to 4 feet at the floor. Over the whole a solid frame roof was placed, which supports a covering of soil 2½ feet thick. Ventilation is secured by six ventilators which are placed three feet from each other, and which rest with lower ends upon the floor of the silo, the upper end protruding one foot above the covering of soil upon the roof. Along, and underneath the floor of the silo an air channel runs, of about a cubic foot in space, which is connected at each end of the silo with air shafts, which, as the ventilators carry off through the roof

the unwholesome and heated air from the interior of the silo, replace the bad air with fresh air from outside. The six ventilators are let into the air channel running under the floor of the silo; consequently as the hot and foul air passes off the replacement with fresh air is immediate and complete. The ventilators are opened and closed as the degree of temperature of the air requires. The beets in the silo were packed in moist sand, each layer of beets being interlaid with an inch layer of sand and not being allowed to touch each other. The use of moist sand was made in compliance with the principle of siloing which includes the securing of a low temperature, in order that growth shall not proceed, and a moist atmosphere, which prevents a loss of moisture from the beet by evaporation; in brief, that the normal conditions of the organism may remain unchanged during the period of storage. The beets were laid up to within 6 inches of the ground surface, the space between the last layer and the roof of the silo being left vacant, the air space acting as a protection against low temperature and also for ventilation.

In order to observe the operation of the mode of siloing with respect to the loss of weight, and incident changes in the organism of the beet, as a consequence of its vitality and of evaporation, a given number of beets, whose weights had been taken, were placed in the middle of the silos and tags attached to each beet bearing the weight. In the spring those beets were reweighed and the change in weight ascertained. Out of ten beets placed thus in the silo only three could be relied upon, the tags upon the others having become so saturated by the moisture that the numbers were no longer legible. The results obtained with the three beets were as follows:

Date.	No. 1 beet.	No. 2 beet.	No. 3 beet.	Total weight.
	Grams.	*Grams.*	*Grams.*	*Grams.*
November 2	800	758	781	2,339
April 8	797	780	768	2,345

There is a difference of behavior observed by the individual beets, but the total result shows a gain of 6 grams in weight, which indicates that no change had taken place, practically, in the water contents of the beets.

The beets had already commenced to shoot at the time that the silos were opened, small, yellow leaves appearing on most of those which were exposed to the faint light admitted through the ventilators. A small loss of sugar was, without doubt, caused by the premature growth which would have been prevented by removing the beets three weeks earlier from the silos and placing them in the earth, the temperature of which was little above the freezing point. The only modification that could have been made with advantage in the control of the silos and mode of preservation was the removal of the beets from the silos in the early part of March instead of the second week in April. The moving of the dense mass in which they were packed and placing the roots in single layer in the cold earth 1 foot from the surface would have deferred even the initial degree of growth which had occurred until the period of "planting out," which is the latter part of April and early May.

In the work of analysis just so many beets as were required for one day (the mean day's work was 450 beets) were taken out of the silo in the morning, the silo being at once closed up and the light shut out. The sample was taken out of each beet with an auger-like sampling machine, the sample consisting of a cone of the size of a man's fore-finger. The pulp is obtained in a finely comminuted condition. The cone or sample is taken from the beet in a diagonal line, the borer entering the beet at its lower end and passing diagonally through towards the top, care being taken that the outer rind of the beet is not punctured and broken through by the instrument. The latter precaution was observed in order that the beet, when planted out in the ground, shall present an intact surface to the weather conditions, and in particular that rain water shall not be able to run into the root.

The sample, is brought into a hand-press and the juice completely expressed. In the extracted juice the sugar content is determined by means of the polariscope.

Each beet is sampled and its richness in sugar determined according to the method given, and the sugar content is made the basis of a division and classification of the beets into grades, which are distinguished from each other by their less or greater richness in sugar. The actual method of classification which was followed is seen from the following details. Each beet is numbered. The juice expressed was placed in a beaker, marked with the same number. The number of the juice was retained through each process of the analysis, and until it was recorded in the book of analyses, with *the per cent of sugar that it contained.* The beets were then classified acording to the data obtained.

After the classification of the beets, which had made up the work of the day, they were immediately placed in the earth, in pits 1 foot deep, and covered with soil to a height of 1½ feet. Each grade of each variety was carefully placed to itself, and the beets were laid in the pits with the heads downwards, in order that they should rest upon the floor of the pit, whose temperature was still nearly at freezing point, and protected from the increasing heat of the mid-day April sun. In those pits the beets remained until taken out for immediate planting.

In stating the analytical results, in the first place, a table will be given showing the actual sugar content of the beets of each variety as they came out of the silos and the mode of variation of the sugar content between the minimum and maximum. Afterwards, the sugar content of the beets at the time of removal from the silos will be compared with the amount of sugar present in the beets at the time that they were taken out of the soil in the previous autumn (October) and at the time when they were placed in the silos for the winter (November).

Table giving the sugar content of the beets of each variety, and the mode of variation of the sugar content between the minimum and maximum.

Variety.	9 per cent.	10 per cent.	11 per cent.	12 per cent.	13 per cent.	14 per cent.	15 per cent.	16 per cent.	17 per cent.	Total beets.
Vilmorin's Improved	38	161	268	295	170	50	4	.....	.....	986
Dippe's Kleinwanzlebener	37	115	196	245	211	53	8	1	.....	866
Desprez	144	337	331	243	78	10	3	.....	.....	1,146
Lemaire	44	93	127	99	59	8	3	1	.....	434
Knauer	58	166	169	128	79	32	4	2	.....	638
Kleinwanzlebener Elite	32	72	93	76	50	30	8	3	1	365
										4,435
Rejected beets, or such as contained less than 9 per cent of sugar										445
										4,880

The data contained in the above table give the content of sugar in the beets at the time of their removal from the silos in April. The normal and real sugar content and standard of quality of those beets was the per cent of sucrose found in them by analysis in the previous autumn, and when the crop was at its period of maximum value. But the data in the table given, placed in comparison with the known sugar content of those beets last October, show the loss of sugar which had taken place between the date of harvesting the beets in the autumn and removal from the silos in the spring. And these data are of the first value in studying the results obtained by different modes of autumn and winter preservation, and of observing the period when the greatest loss of sugar takes place.

The mother beets were not placed in the silos at the time of harvesting the crop; they were put into small pits in the field as soon as they were removed from the soil, and they remained in those pits three weeks, after which they were transferred to

the silos for the winter. The following table shows the content of sugar in the beets of each variety as indicated by analysis on the given dates:

Variety.	1891.		1892.
	October 15.	November 6.	April 10.
	Per cent.	*Per cent.*	*Per cent.*
Vilmorin's Improved	14.6	12.9	11.90
Dippe's Kleinwanzlebener	14.5	12.5	12.12
Desprez	14.4	12.5	11.12
Lemaire	14.1	13	11.44
Knauer	14.8	11.6	11.37
Kleinwanzlebener Elite	14.5	12.7	11.86
Means	14.5	12.5	11.65

The above table shows that the sugar content of the mother beets had fallen, between the dates of October 15, 1891, and April 10, 1892, 2.85 per cent. It is likewise observed that the chief loss of sugar took place between October 15 and November 6, the reason of which circumstance will be discussed on a later occasion and in relation with certain other data on the subject.

It has been shown by the latter table that practically a loss of 3 per cent (2.85 per cent) of sugar had taken place in the mother beets between the time of harvest in the autumn and the dates of their removal from the silos in the spring. That amount requires to be added to the sugar content of each beet analyzed in the spring, in order that the normal and real quality shall be understood, and that the actual quality of the several grades, which were planted for the production of seed, shall be clearly established upon the normal sugar content of the beets at the period of maturity in the previous autumn. It is very evident that the sugar content of the beet at the time of full development and ripeness is the actual expression of its standard of quality, since the content of sugar found in the beet in the spring is wholly dependent upon the mode of preservation which has been adopted, and it is possible to treat the beets in a way which would cause a loss of more than one-half of the sugar contained.

The beets of each variety were resolved into three grades of quality, distinguished from each other by the sugar content. The following table gives the normal sugar content of the beets of each grade, with the number of beets of each grade planted:

Variety.	Extra quality beets containing from 18 to 20 per cent.	No. 1 grade beets containing from 16 to 18 per cent.	No. 2 grade beets containing from 12 to 16 per cent.
Vilmorin's Improved	4	220	762
Dippe's Kleinwanzlebener	9	264	593
Desprez	3	88	1,055
Lemaire	4	67	363
Knauer	6	111	521
Kleinwanzlebener Elite	12	80	273
Total	38	830	3,567

The setting out of the mother beets was done on May 4, 5, and 6. The varieties were planted at points on the station field of extreme distance from each other in order to prevent the action of insects in hybridizing. The beets were planted in rows 3 feet apart, with a distance of 2 feet between the beets in the row. The planting was done by hand, the beets being set into the ground at a depth which left the head of the beet level with the surface. The soil was pressed moderately around the beet as it was placed in the hole, care being taken not to damage or break off the young shoots which were making an appearance.

Extremely favorable weather for the mother beets succeeded the time of setting out, and the roots took an almost immediate hold of the ground. In ten days the foliage was 6 inches high, and there were not more than twenty beets out of the 4,435 planted which did not grow and produce seed.

The ground around the beets was kept clean and loose by hand-hoeing, the operation being repeated three times during the season of growth.

The progress of growth was steady and strong up to July 15, at which date the vigor of the crop and the "seed-stand" were magnificent. After that date a period of extremely high temperature set in, which continued almost without a respite up to the end of August, and, with the high temperature, a minimum rainfall was recorded, which combined conditions of weather produced a premature and somewhat irregular ripening of the seed. It was estimated that the seed would be ready for gathering about August 15; but, in consequence of the conditions of the weather described, a first portion of the prematurely ripened was collected on August 5. The first collection was small and somewhat dried up, but had an abundant vitality. The second collection, made from August 12 to 16, was seed of excellent size, weight, and quality. The third and last collection, made from August 20 to 24, was good and of perfect maturity, but hardly so bright in appearance as the second collection.

The seed was gathered by hand, being stripped from the branches of the stand. By making three several collections all the seed was obtained in a perfect condition of maturity. When gathered, the seed was laid out in the sun upon boards and pieces of burlap and thoroughly dried, after which it was separated from particles of leaf and branch by use of a winnowing machine. The winnowing or cleaning process not only blew out all dust, leaves, and shreds of branches, but the seeds of undersize, underweight, and imperfect maturity were also separated, thus producing a sample of seed of excellent appearance, and sound and high quality. The seed from each grade of mother beets of each variety was collected, cleaned, weighed, and preserved separately. The extra quality grade will be used exclusively upon the experiment station in further high-class experimentation. No. 1 grade will also be used, in some portion, by the station for experimental purposes. No. 2 grade, which may be considered as seed of an ordinary commercial quality, will be distributed or sold for the production of beets for factory use.

The actual results obtained with the six varieties used in the production of seed are shown in the following table, in which the area of ground planted and the weight of seed collected are given:

Variety.	Area.	Weight.	Yield per acre.
	Rods.	*Pounds.*	*Pounds.*
Vilmorin's Improved	20	117	936
Dippe's Kleinwanzlebener	20	128	1,024
Desprez	24	92	613
Lemaire	10.3	66	1,056
Knauer	15.0	126	1,344
Kleinwanzlebener Elite	9	66	1,173
Total	98.3	595	1,025

The actual yield from 98.3 rods of collected, cleaned, and weighed seed was	pounds	595
Yield per acre		968
Value of 595 pounds, at 20 cents per pound		$119.00
Value per acre		193.60

A record of the cost of production of the seed was not made. Such an estimate or record would be of an extremely complicated character; including the cost of the production of the mother beets in the previous year, the expenses of siloing, analyzing, and classifying the mother beets, in addition to the cost of cultivating and harvesting the seed. Nevertheless, such an estimation of the cost of seed production will be made in the immediate future.

These experiments, which represent the first endeavor to produce sugar-beet seed by the strict methods of selection and culture which are practiced in Europe, and which have brought the European varieties to their present standard of excellence and value, are a trustworthy, although an initial, indication of what it may be possible to accomplish in the soil and climatic conditions of the region in which the station is located. However, nothing more can be stated with assurance until the *home-grown* seed has produced at least one generation of progeny, and it is found that the beets grown from the seed are equal in size and content of sugar, and the seed produced from those beets equal in quality to the seed imported from Europe and the beets grown therefrom. So far, the indications are full of promise of success.

CULTURAL SEASON OF THE BEET CROP.

The cultural season of the beet crop of 1892 was begun in October of 1891. The plowing and subsoiling of the land intended for planting in beets were done in the third week of October, and comprised the autumnal preparation for the next year's crop.

With the exception of three acres which had produced beets in 1891, the whole of the remaining portion of the station field had been laid to fallow in the summer of that year. The ground was virgin prairie, which had not produced a crop, and it was essential, in the first place, that a mode of treatment of the soil should be adopted by which the excess of undecayed organic matter would be most rapidly changed and reduced to the measure not inimical to sugar-beet production.

Breaking up the ground to a depth of 9 inches, in May, 1891, and a method of fallowing which kept the soil in motion and exposed to the action of the air and sun during the course of the summer, was a means of causing the most rapid oxidation and decay of the vegetable matter, and of converting the superabundance of organic nitrogen into inorganic forms, capable of being utilized for plant nutrition. An analysis of the soil had shown that the nitrogen present in the soil at a depth of 12 inches was as great as the amount found in the upper 6 inches, and for that reason the fallowing was conducted to a depth of 9 inches, in order that the largest possible mass of soil should be exposed to the action of the air.

In October the land of nearly the whole of the station was in the condition produced by such a course of fallowing. The plats selected for bearing beets in the following season were again plowed and to a depth of 10 inches, and subsoiled to a depth of 6 inches, thus securing the stirring of the soil to a depth of 16 inches. The width of furrow taken by the plow was 10 inches, or a width no greater than could be moved by the share of the subsoiler. In such a way the land was laid up for the winter, and was not touched again until the season of preparation in the following spring.

The work of preparing the soil for the reception of the seed was commenced in the spring on April 24. The act of preparation of the seed bed was delayed later than was desirable by the wet condition and low temperature of the soil. It is, however, more advantageous and better practice to delay the operations if the condition of the ground is not satisfactory.

The labor in the spring preparation of the seed bed was reduced to a minimum by the work of heavy cultivation which had been done in the autumn, and the fine state of pulverization of the soil which had been wrought by the action of frost during the winter. The actual preparation for planting was made in the first place by moving the ground to a depth of 5 inches with a disk harrow; afterwards a two-horse harrow was put twice over, when the ground was rolled down and the seed put in. After drilling in the seed with a one-row horse drill, the ground was rolled a second time. The details in the work of preparation and light cultivation of the ground were in the most part identical with the same in 1891, the latter being described in full in the report of that season.

The varieties of beets grown upon the station in 1892 were the Vilmorin Improved, Dippe's Kleinwanzlebener, Desprez, Le Maire Père et Souer, Kleinwanzleben Elite, and the Original Kleinwanzlebener. The variety Ferd Knauer, which was one of the six varieties grown in 1891, was replaced in 1892 by the original Kleinwanzlebener, owing to the circumstance that seed of the former variety could not be procured in time for planting.

Before planting, the quality of the seed of the six varieties was tested by special germinations, which were conducted in the station laboratory, and the degree of vitality observed is given in the following table, which states the rate as well as the measure accomplished by each variety.

Vitality of seed.

[One hundred seeds of each variety were planted; date of planting, April 27.]

Varieties	Vilmorin's Improved.	Dippe's Kleinwanzlebener.	Desprez.	Lemaire.	Kleinwanzlebener Elite.	Original Kleinwanzlebener.
Visible on—	*Plantlets.*	*Plantlets.*	*Plantlets.*	*Plantlets.*	*Plantlets.*	*Plantlets.*
May 1	8	0	0	3	1	0
2	20	2	0	7	7	0
3	54	31	0	30	55	22
4	78	50	8	56	80	62
5	89	59	20	66	85	84
6	93	66	26	81	85	89
7	94	70	29	85	85	89
8	96	70	33	85	85	89
9	96	70	36	85	85	89

The notable features in the germination are the high vitality of the Vilmorin variety and the extremely low germinating power of the Desprez.

April 30 the first seed was planted. One acre was drilled with seed of the Vilmorin Improved variety. The ground was in the finest condition of tilth, the seed bed being a mass of fine moist mold, and the temperature of the soil was 54° F.

Heavy rains immediately followed the first planting, and all further planting was delayed until May 20. The rains were accompanied with extremely low temperature, which caused a lowering of the temperature of the soil of 12° from the date of planting the first seed on April 30. The coldness of the ground delayed the germination of the seed, and the plantlets of the seeds sown on the last day of April were not visible along the rows until May 18, which was nearly twice the length of time occupied by normal germination. From May 20 the temperature of the air rose rapidly, and an equally rapid response was seen in the state of warmth of the soil.

The action of temperature upon germination was well illustrated during the period of planting, and some observations of interest are given in the following table:

Variety.	Date of planting.	Mean temperature of soil.		Date of appearance of plants.
		Days.	°	
Vilmorin's Improved	Apr. 30	18	46	May 18
Dippe's Kleinwanzlebener	May 20	10	56	May 29
Desprez	25	9	60	June 3
Lemaire	26	7	60	June 2
Kleinwanzlebener Elite	26	6	61.5	June 1
Original Kleinwanzlebener	31	5	64	June 4

Flat-hoeing was begun May 27, upon the plat planted on April 30. The ground was extremely soddened and caked by the heavy rains that had fallen during May and the hot sun at the latter part of the month. By hoeing, the plants were re-

leased from the encrusted condition of the surface, and they made a rapid growth, so that on June 8 they were large enough for thinning out.

The later-planted plats made a rapid growth; and, with the exception of the plat planted with the Desprez variety, all were a full and regular stand. In such respect, the season of 1892 was much more advantageous than the season of 1891. In 1891 the period of germination was extremely dry, and the plants came up at two different times. The planting season of 1892 was very moist, and all the seed germinated simultaneously.

The work of thinning out commenced June 8. Several of the workmen who had been employed upon the station in 1891 applied for further service, and they were reëmployed. Those men were already fairly well acquainted with the nature of the operation, and not only was the difficulty of training green hands very much lessened, but the amount of labor accomplished daily by each man was very greatly increased and the cost of the operation proportionally reduced.

The saving in time and expense which was effected by the greater skill of the workmen in the operation of thinning out the beets was the least important indication of increased expertness. The work was done in a precise, clean, and effective manner, and with a minimum of damage to the standing plants. Special experiments conducted last year showed that an unskillful handling of the plantlets in the process of thinning out may produce results of a disastrous character. It was seen that when the plants which are left standing are unduly disturbed in their connection with the soil, by the act of removing the surplus plants, not only the growth but the form and sugar content are later most materially affected. Those experiments were repeated in the season of 1892, and with results of a still more emphatic character. Plantlets which had been roughly handled were afterwards taken out of the ground and examined under the microscope. It was observed in each of thirty examples that the end of the taproot of the plantlet was ruptured and the rootcap was displaced. Further, a given number of such plantlets were replanted in a row parallel with another row of plants which had been thinned out with particular care, and the two rows were allowed to grow, under conditions in every other respect analogous, until the period of maturity, when the plants of each row were taken up, examined, weighed, and the sugar contents determined. In the first place, the beets from the row which was manipulated with great care at the time of thinning out, were perfect in form, without exception. The beets, however, from the transplanted, and more or less injured, plantlets exhibited an extreme degree of deformity. Amongst ten of those beets eight had failed to develop a taproot, and in place thereof three to five coarse prongs or fingers had grown out. The beets were utterly deformed, and without any points of resemblance to the other beets grown by the side of them. The weights and sugar contents of the respective beets were as follows:

	Number of beets.	Weight of beets (mean of 10 beets).	Sugar content.	Purity of juice.
		Grams.	*Per cent.*	*Per cent.*
Deformed beets	10	358	11.6	74.4
Correctly formed beets	10	324	15.0	79.7

It is seen that while the well-formed beets were of an excellent quality, the deformed beets were below the standard (in sugar content and purity of the juice) required for manufacturing purposes. And the results of those experiments urge a still more emphatic insistence upon care and a correct mode of manipulation being practiced in the operation of thinning out the beets. If the success of a crop can not be wholly assured by care and expertness in the work of thinning out, its prospect and value will be decidedly ruined by ignorance and neglect at that particular period in the history of the plant.

Thinning out of all the plats was completed on June 18. The work was accomplished, in all respects, in an almost perfectly satisfactory way. The distance between the rows, upon all the plats, was uniformly 18 inches. The distance between the plants in the row was, in the early-planted plats, 8 inches, and in the late-planted plats, 9 inches. The plants appeared to be of one uniform size, and the distribution over the ground showed the utmost attainable regularity.

About five days after the operation of thinning out the horse hoe was passed over all the plats. The ground, however, was particularly free from weeds, which was, in part, owing to the following of the previous summer, and likewise to the circumstance that the ground was thoroughly moved by the hand and horse hoes as soon as the plantlets were visible in the rows. One day's labor, employed before the weeds have gotten a stronghold of the ground, will save the labor of several days later in the season. After the first time horse-hoeing, the hand hoe followed amongst the plants, every stray weed being cut out, the ground thoroughly removed, and the "double plants" drawn out which had been overlooked in the operation of thinning out. The hand-hoeing was again followed by the horse hoe, the operation being twice repeated at intervals of one week. The ground at the end of those operations was not only free from weeds, the surface, to a depth of 3 inches, was in a state of great fineness, looseness, and porosity, which condition favored a ready circulation of air in the upper layer, and prevented the rapid escape of moisture from the lower soil.

The operation required to complete the work of cultivation was the "soiling up." The foliage of the beets, as well as the root development, were too far advanced to allow of further work being done either with the horse or hand hoes, excepting the act of drawing up the loose soil from between the rows around the plants in the rows. That operation was performed between July 7 and 13. Upon the latter date the cultural period of the season closed (with the exception of some detail work conducted on certain very small plants, which will be spoken of later and in relation with the results obtained).

AN INSECT VISITATION.

The high condition of promise which the plats of all varieties exhibited in the middle of July, when the cultural work closed, was not maintained very long. On July 20 it was observed that a caterpillar had appeared upon the foliage of the beets, and in very threatening numbers. Although the visitation of those insects was extremely localized, and the sphere of their operations confined to patches of small area, yet the total damage was very great. Efforts were made to destroy the caterpillars before they could get into the ground to prepare for the production of a second generation. Preparations of Paris green were applied with sprinkling cans, the whole of the attacked portions of the plats being treated. Also Persian insect powder and white hellebore were tried, but the difficulty of applying insecticides in the form of a dry powder, and particularly in the presence of the winds which are usually blowing in Nebraska, rendered the application of substances in solution or suspension a more convenient and likewise a more effective operation. Paris green in suspension (one teaspoonful to one gallon of water) was applied to all the plats which were attacked, and evidently with a very considerable effect. Twenty-four hours after the application of the insecticide great numbers of the caterpillars were lying dead upon the ground. Unfortunately, however, the application of the Paris green was not made until a great number of the insects had left the leaves and gone into the ground, there to go through the stages of metamorphosis previous to their reappearance in the winged form as moths.

In the meantime communications were being conducted with the Division of Entomology at the U. S. Department of Agriculture, Washington, D. C., concerning the character of the visitation, the natural history of the species, and the mode of lessening the ravages or destroying the insect. On August 5 a communica-

tion was received from Mr. L. O. Howard, acting Entomologist, in which he said: "The matter is a very interesting one, and the insect is new to us. It seems to be a near relative to the so-called garden webworm (*Eurycreon rantilis*) which did great damage to cotton, corn, and many garden vegetables in Kansas, Colorado, Nebraska, Indian Territory, and northern Texas in 1885. It is a different species, however, and I find no account of it in the literature of economic entomology. It is quite likely that another generation will appear this summer unless your remedial measures have been extremely effective. The record of your experiments is very interesting, and there is no question but that the Paris green treatment is the best, everything considered. It would be desirable for you to determine the amount of Paris green which can be applied in solution without burning the foliage of the sugar beet, as this point has not heretofore been definitely ascertained."

Certain experimental data had already been obtained upon the question of the strength of solution of Paris green required to effectually destroy the insects in great numbers; and certain general, but no specific, observations had been made in order to determine the strength of solution that could be applied without damage to the beets. It was found that a solution containing one teaspoonful of Paris green to 1 gallon of water was effective in destroying all insects that were upon the upper surface of the leaves, and which ate of the sprinkled material. Many of the caterpillars, however, were upon the underside of the leaves, where they were protected from the insecticide applied, and, moreover, continued to feed upon the epidermis of the under leaf with complete immunity from its action. For the reasons indicated in the above remarks the application of insecticides can be only partially effective.

There is further the consideration of damage done to the crop by the application of insect-destroying substances. Where a solution of Paris green of the strength already given was applied and an overdose fell upon certain leaves those leaves were burnt through into holes, or turned brown in the places where the arsenical mixture lodged. However, a solution of the strength stated did not do an appreciable amount of damage, either to the foliage or the roots.

The intimation made by Mr. Howard, that a second generation of the insect might be expected to appear during the summer, caused a most careful daily attention to be given to the matter. The caterpillars of the first generation had wholly left the beets on August 1. On August 8 a number of gray-colored moths was observed. By the following day the number of those moths appeared to have increased a thousandfold. If the foliage of the beets was disturbed they rose in cloud-form, and they were generally distributed over the greater portion of the plats.

About 100 of those moths were caught, inclosed in a box, and sent to the Department at Washington. In speaking of them, Mr. Howard said:

"In my last letter I hazarded the guess that the insect would prove to belong to the genus Eurycreon, and that it would be closely allied to the common garden web worm of Kansas, Nebraska, and other Western States—Eurycreon rantalis. The moth you sent is *Eurycreon stictalis*. Please watch the eggs which it is depositing upon the beet leaves, and send us larvæ which may hatch from them."

The leaves of some beets were examined under the microscope and the eggs of the moths observed. The eggs were deposited in minute groups, and exclusively upon the underside of the leaves. On August 20 the eggs were noticed to be hatching out, and numerous caterpillars of a very minute size were already upon the leaves. On the following day it appeared as though the whole crop were infested and doomed to utter destruction. Upon some plants 150 insects were deposited and were consuming the foliage at an extreme rate. No time was lost in the effort to destroy the second generation before it got a complete hold of the crop. Arsenicals were applied by sprinkling, the solution containing one teaspoonful of Paris green to a gallon of water. All the plats were treated with the insecticide, and at the rate of three pounds per acre. When the Paris green solution had been upon the crop only about eight hours a heavy rain began falling, which washed every trace of the

material from the leaves down into the neck of the beets or into the ground, and the application was without effect. The crop had already been treated twice with the arsenical, and where it had become deposited in considerable quantities in the necks of the beets the indications were that a further application could not be made without direct damage to the crop, and rendering it possibly unfit for manufacturing purposes. Consequently, no further attempt at destroying the insects was made with Paris green. Powdered quicklime and also soot were scattered over the patches which were the worst affected, but without any perceptible effect. It was likewise attempted to cross the rows with a light roller, and thus crush the caterpillars, but the latter appeared able to bear the operation with less destruction than the beets. Nothing could be done to stop the ravage of the insects. Had the rain not fallen so soon after the treatment with Paris green the application would very probably have been in a great measure effectual. As it was, no good was done, and nothing was considered of any possible value in the situation.

The caterpillars followed their natural course, and until the greater portion of the foliage of the crop was eaten down to the ground, only the northern ends of certain plats, bearing four different varieties, escaping the attack. But the ends of those plats were fortunately not in the least attacked by the second generation of the insect, although they suffered somewhat lightly from the ravage of the first generation, and they afford the data required to form a comparative estimate of the damage wrought by the visitation. Those data are shown in the following table, which is the record of the weights of the varieties upon a given date, and likewise of the weights of the portions of the plats which suffered from and those which escaped the attack.

Variety.	Date.	Yield per acre of insect-damaged beets.	Yield per acre of undamaged beets.
		Tons.	*Tons.*
Desprez	Oct. 15	10.9	16.8
Lemaire	15	10.9	15.8
Kleinwanzlebener Elite	15	9.8	16.0
Original Kleinwanzlebener	15	10.4	18.6
Mean		10.5	16.8

The difference shown in the two columns of the table indicates the actual loss in weight per acre of the beets of those varieties, caused by the insect visitation upon the station crop.

The visitation was observed in portions of the beet districts of the Grand Island and Norfolk beet-sugar factories. I was instructed to visit and inspect the beet fields of those districts, and to report upon the condition of the crop and the extent and ravages of the insect attack. Frequent inspections of the attacked fields in the districts specified were made, obtaining further data upon the nature of the visitation, and making such suggestions to the growers as had any appearance of value. The work of inspection was extremely facilitated through the active aid and courtesy extended by the Oxnard Beet-Sugar Company and the enterprising gentlemen in its service.

The climatic conditions prevailing at the time of the first visitation, and extending through the whole period, embracing likewise the appearance and duration of the second generation, were of an extreme character. An abnormally high temperature marked all that part of the season of which we have spoken, and the rainfall for June and July was unusually small. These data require to be considered in connection with the appearance of the insects and with the question of a probable recurrence of the visitation in the coming season. (By direction of Secretary Rusk, that portion of the Entomologist's annual report referring to this insect pest is appended to the present report.)

The climatic conditions prevailing during the cultural season of 1892 are given in comparison with the data for 1891, and with the normals for the district of the experiment station:

Rainfall.

Year.	May.	June.	July.	Aug.	Sept.	Oct.	Totals.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
1892	6.62	0.50	2.50	3.36	0.28	1.00	14.26
1891	1.38	11.59	6.71	2.22	0.84	3.92	26.61

The mean rainfall of the northern and southern districts of Nebraska for the same months: May, 3.50 inches; June, 3.68 inches; July, 3.09 inches; August, 2.96 inches; September, 1.57 inches; October, 1.50 inches; total, 16.30 inches.

Temperature.

Year.	May.	June.	July.	Aug.	Sept.	Oct.
1892	55.3	66.6	75.00	72.85	66.56	56.3
1891	59.0	68.4	69.90	70.20	65.10	47.6

Total units of heat for the given six months in—

1892	12,036
1891	11,651
Normal for same period	11,548

The climatic conditions of the cultural season of 1892 were characterized by a temperature considerably above the normal, and a rainfall not only little more than one-half of the rainfall of the cultural season of 1891, but very considerably below the normal precipitation. It is further observed that during the months of June and July, when the chief precipitation of the year takes place, the rainfall was phenomenally small. The rains of June and July are a chief factor in the development of a normal vegetation, and when that factor is irregular the measure of vegetable growth will vary in a similar way.

ANALYTICAL WORK OF THE SEASON.

The work of analyzing the beets was begun on September 1, with the assistance of C. B. Edson, of the station laboratory. On September 5, T. C. Trescot took charge of the polariscope and conducted the analytical work until the close of the season.

The condition of the crop on September 1 was in no measure what it should have been at that period in the season. In the place of the old foliage, which had been almost wholly consumed by the caterpillars, an absolutely new growth was in the stage of half development, so that the plats more nearly resembled their appearance on the last day of June than what they should have been on the date spoken of. The destruction of the old foliage not only caused a check in the growth of the roots; the sugar content of the beets was kept abnormally low, and by the production of the new set of leaves the sugar content was reduced to a still lower point. It was in the midst of the conditions of that period that the work of analysis was begun.

The mode of determining the results and value of the plats of each variety was by ascertaining the weight of beets per acre, and the content of sugar in the beet, and calculating from these factors the yield of sugar per acre.

The determination of the weight of beets per acre was conducted strictly according to the method adopted last year, and which is given in full detail in the report

of 1891, contained in Bulletin 33, Division of Chemistry, U. S. Department of Agriculture. In the season of 1892, however, the weight of the crop was taken twice, on September 15 and October 15, the latter date representing the period when the weight was at the maximum and growth had ceased. Each time when the weight was ascertained, the method consisted of taking up precisely 1 square rod of beets, which measure was determined by the use of a wooden frame 1 square rod in dimension. When the frame was laid down on the place selected, all the beets inside the square were gotten up, thoroughly cleaned, topped, and weighed, and the weight of the square rod taken as the unit of the acre.

The weights per acre of the six varieties grown are given in the following table:

Variety.	September 15.	October 15.
	Tons (per acre).	*Tons (per acre).*
Vilmorin's Improved	10.3	12.5
Dippe's Kleinwanzlebener	12.3	13.3
Desprez	16.5	16.8
Lemaire	15.1	15.8
Kleinwanzlebener Elite	15.7	16.0
Original Kleinwanzlebener	15.6	18.6
Mean	14.25	15.8

The weights given in the column under date of October 15 indicate the maximum weight per acre of each variety, and in that portion of the plats which suffered the least from the insect ravage. The attack of the caterpillars upon the ground planted with the Vilmorin's Improved and Dippe's Kleinwanzlebener varieties extended over the whole of those plats, and such is the precise explanation of the lower yield in comparison with the other four varieties. It is seen that an increase of weight was made between the middle of September and October 15, which observation is confirmed by the increased weight of the individual beets which gradually took place during that period.

As it has already been said, the work of testing the beets in the laboratory was begun on September 1. The mode of conducting the examination of the varieties was somewhat different from the procedure in the analytical season of 1891. There were six varieties grown. Commencing with the Vilmorin's Improved on September 1, the other varieties followed in the order in which they are recorded in the table of the weight determination. By giving one day to the examination of a variety the whole week was required for the testing of the six varieties. In such order, each variety was examined upon the same day every week, the work being continued without intermission from the first week of September until the second week in November. By such a mode of examination, and chemical control of the crop, the relative conditions of the varieties at the time of beginning the analytical work, the behavior of each variety under the fluctuating climatic conditions, and the rise of each toward its maximum value, with the gradual decline from the maximum, as the season approached the close, were clearly established.

In preparing the samples for analysis the method adopted last year was strictly followed. In order to obtain a reading or test of a variety never less than 100 beets were taken, and the usual number was 200 beets. Those beets were taken in "twenties" from five different parts of the selected row in the plat. Each "twenty" was taken consecutively, large and small, as the beets were standing, and in no case was a sample taken by selecting individual beets from different places in the row or selected parts of the plat. When taken up the beets were immediately taken to the laboratory and washed, dried, and weighed without any delay. The 200 beets were not all taken up in the morning, but only one-half of that number, and the second hundred was gotten up after the first part was analyzed and recorded. The ob-

ject of those precautions was to allow no time for loss of weight in the beets before the juice was expressed, and thus avoid obtaining too high polariscope readings. All beets and samples of beets were analyzed in their normal condition, or in the exact state in which they left the soil, consequently the analyses of the station laboratory are correct readings of the actual sugar contained in the crop upon given dates. The errors proceeding from analyses which are made with beets that are more or less dried out will be considered in a later part of the report.

The beets, which had already been washed, dried, and weighed, were at once ground up, and the juice expressed from the pulp. The first hundred beets each day were analyzed individually, and the juice from each one was expressed with a small hand-press and the use of small filtering bags. The beets of the second hundred were always ground up in "tens," and the juice from each "ten" obtained in one sample, the expression of the juice being accomplished by the use of a high-power screw-press.

The question concerning the relative richness in sugar of the first and second portions of the juice expressed from a sample of beets is not yet generally decided. An experiment was made by the station laboratory, 100 beets being used for the purpose, and the pulp of 10 beets going to one analysis. The relative sugar content of the first and second expressions are given in the following table. The first half of the juice was obtained by expressing with the hand, and the second half by the heavy screw press, each portion being, as it is designated, an exact half of the total juice capable of being expressed.

Number of beets.	First half of juice.			Second half of juice.		
	Brix.	Sucrose.	Purity.	Brix.	Sucrose.	Purity.
	Degrees.	*Per cent.*	*Per cent.*	*Degrees.*	*Per cent.*	*Per cent.*
10	18.8	14.6	77.6	18.7	14.8	79.1
10	19.4	15.6	80.4	18.9	15.5	82.0
10	17.3	14.0	80.9	17.4	14.1	81.0
10	18.1	13.7	75.7	17.2	13.8	80.2
10	16.8	13.4	79.8	16.7	13.0	77.8
10	19.0	14.9	78.4	19.0	15.0	78.9
10	18.4	14.6	79.3	18.4	14.9	81.0
10	18.9	14.4	76.2	18.7	14.8	79.1
10	18.5	14.1	76.2	18.7	14.7	78.6
10	19.9	15.8	79.4	19.4	15.5	79.9
Means	18.5	14.5	78.4	18.3	14.6	79.8

The table shows that the juice of the second expression was not only slightly richer in sucrose but notably higher in purity than the juice of the first half.

It has been stated that of the 200 beets analyzed each day, 100 were tested individually, and the second 100 by grinding 10 beets together, expressing the juice from the whole pulp, and taking one sugar reading of the whole. The object of handling a given number singly was to observe the degree of variation in the weight and sugar content of the individual beets. But the reasons for analyzing in bulk, as it may be termed, where a number of beets are analyzed collectively, are several and important. It is known that small beets are usually richer in sugar than large ones. When 100 beets are analyzed individually the sugar content of each is recorded. In obtaining the mean sugar content of the 100 beets, the small beets not only count for as much as the larger ones, they bear somewhat more towards the result because of the greater richness in sugar. The proportion, by weight, of the small beets to the aggregate weight of the crop, however, is in the opposite direction. A crop composed at the rate of 100 beets weighing 200 grams and 100 beets weighing 400 grams indicates that the larger beets compose two parts in three of the whole crop, and the smaller beets only one part in three of the same. It will thus be observed that if the yield of sugar per acre be calculated from the weight of beets per acre and the mean sugar content of the individual beets, the result

will be too high. That error is corrected by analyzing in bulk, or taking the mean sugar reading of ten or twenty beets which have all been ground up together. If the smaller beets are richer in sugar they yield a less quantity of pulp and juice, and only influence the actual sugar reading in the exact relative proportion. Consequently, the sugar readings of beets which have been analyzed in bulk furnish the actual sugar content of the crop; and when the mean of those readings is taken in calculation with the weight of beets per acre the exact yield of sugar per acre is given. The only exception to the statement that "the smaller beets are richer in sugar than the larger" occurs in the early part of the season, and before the crop has reached maturity. The larger beets mature somewhat earlier than the smaller ones, and in the first period of the ripening season it is found that the larger beets give a higher sugar reading in the mean than the small beets; but that difference is quite reversed in the end.

Having explained the mode of obtaining the samples of beets in the field, the preparation of the beets for grinding, and the method of securing a juice whose sugar content is, as nearly as possible, a true reading of the richness in sugar of the crop, the analytical data relating to each variety will be given, extending from September 1 to the close of the analytical season. The development, history, and results of each variety will be recorded in a separate table, in which the mean weight of the beets, the mean sugar content, and the mean purity of the juice will be given for each week from the opening to the close of the work. The means found in the tables, and which are accepted as showing the actual condition of the variety upon the given dates, are based upon the data obtained from the analysis of 200 beets.

Vilmorin's Improved Variety.

Date.	Number of beets.	Weight of beet.	Brix.	Sucrose.	Purity.
		Grams.	*Degrees.*	*Per cent.*	*Per cent.*
Sept. 1	Mean of 50 beets	216	15.3	12.4	80.2
8	Mean of 200 beets	222	15.0	12.2	81.0
15	Mean of 200 beets	225	14.1	11.7	77.5
22	Mean of 200 beets	252	15.3	11.6	74.5
29	Mean of 200 beets	241	16.9	13.5	80.8
Oct. 6	Mean of 200 beets	230	17.8	15.1	83.0
13	Mean of 200 beets	222	18.2	15.2	83.2
20	Mean of 200 beets	242	17.8	14.6	80.2
27	Mean of 200 beets	240	17.7	14.8	80.5
Nov. 5	Mean of 100 beets	256	16.0	13.0	81.2
18	Mean of 100 beets	243	16.7	13.2	80.4

The behavior of the Vilmorin's Improved variety was peculiar. The peculiarities, however, are more apparent than real, and are wholly traceable to the action of the insect attack. It is seen that on September 1 the sugar content in the juice was 12.4 per cent. From that date until September 22 the sugar in the juice went down. With the apparent loss of sugar a very noticeable increase took place in the weight of the beet, which rose from 216 grams to 252 grams.

From the time that the caterpillars disappeared from the plat, which was about the first three days of September, the beets developed a new crop of foliage, and very rapidly. With the appearance of the fresh foliage a new period of assimilation and growth began, which gradually added weight to the beets. The new growth and the increment of weight of the beet appeared to have been made, in some measure, at the expense of the sugar contained in the beet. That result, however, was only in appearance. As a matter of fact an increase had occurred in the actual quantity of sugar present in the organism, although the sugar content of the juice had decreased. That result may be determined by a comparison of the weights and sugar contents of the beets on September 1 and 22, respectively. On September 1 the mean weight of the beets of the plat was 216 grams. The sugar content of the juice upon that date was 12.4 per cent, which shows that the beet at that time con-

tained 26.78 grams of sugar. On September 22 the mean weight of the beets of the same plat or crop was 252 grams. The sugar content of the juice was 11.6 per cent, or 29.0 grams of sugar, which is a gain of 2.2 grams of sugar during the interval of time considered. The increase of the total weight of the beet, however, had been out of all proportion greater than the increase in the weight of the sugar in the beet, and that circumstance reduced the proportion of the sugar relative to the other constituents of the organism. The chief increase had been made in the water present in the beet, and that caused the sugar and other soluble solids to be contained in a more dilute solution in the juice. The table shows that the Brix reading of the juices on September 1 was 15.3; but on September 15 only 14.1, indicating that a large amount of water had been taken up by the beet.

From September 22 to October 13 the table shows a rapid and notable increase in the sugar richness of the beet, but at the same time a slight falling off in the weight of the beet during the same interval. The increase of sugar was in part actual, and also in part only apparent, and was owing to a concentration having taken place in the juice of the beet by the loss of water. During that period the temperature of the air and soil was extremely high, and the loss of water from the beet by evaporation was greater than could be made up by capillarity. Some of the beets were quite soft from loss of moisture. If the observations are carried on until October 20 a decrease in the sugar content of the juice but a rise in the weight of the beet are observed; and these coincident circumstances are explained by a notable lowering of the temperature of the air and a fall of one-third of an inch of rain. On October 27 the sugar in the juice had risen two-tenths of 1 per cent, but the weight of the beet had slightly fallen. On November 5 a very notable fall had occurred in the sugar content of the juice—from 14.8 to 13 per cent—but a corresponding rise had taken place in the weight of the beet. Now, during the preceding week, 1 inch of rain had fallen, and the temperature had come down to a daily mean of 40 degrees.

If the relative weight of the beet and the corresponding sugar contents are viewed during the period from September 1 to November 5, the behavior of the organism in relation to its sugar content is observed as follows:

Weight and sugar contents.

Date.	Weight of beet.	Sugar in the juice.	Sugar in the beet.
	Grams.	*Per cent.*	*Grams.*
Sept. 1	216	12.4	26.78
22	252	11.6	29.00
Oct. 13	222	15.2	32.60
Nov. 5	256	13.0	33.28

The data contained in the table show that there was a gradual increase in the weight of sugar contained in the beet from September 1 to November 5, and that on the latter date the actual weight of sugar to the acre was greater than at any previous time. The data further indicate that the sugar content of the beet is a more constant factor and less liable to fluctuations under the influence of climatic changes than has been duly considered. The indication emphatically suggested by the observations recorded is that the sugar content of the organism is practically an invariable factor, and that the constituent of the beet which is the factor chiefly subject to fluctuation is the water content, the variability of which is caused and controlled by the temperature of the air and soil, and the rainfall.

A more exhaustive analysis has been made of the data belonging to the "Vilmorin's Improved" variety than will be attempted with the tables of data of the varieties yet to be recorded, for the particular reason that the Vilmorin's Improved plat was selected and controlled with the special purpose of establishing the cost of pro-

duction of the crop. Consequently each detail was observed with a care and accuracy which could not be extended to all the plats in the field. For example, in determining the mean weight of the beet each week, when the variety was analyzed, the removal of the top and neck was always in the same exact proportion. The topping and necking of the other varieties was not always done by the same individual, nor the same proportion of neck always removed. And again, in the case of the Desprez variety, it was found in the first analysis that too small a portion of the beet had been cut off as "neck" before taking the weight, on account of the coarseness of that variety; and in the following week more of the neck was removed, which lowered the mean weight recorded. Nevertheless it will be found that each of the varieties exhibit the nature, mode, and degree of fluctuation from week to week, which were observed in the example of the Vilmorin's Improved variety.

Dippe's Kleinwanzlebener Variety.

Date.	No. of beets.	Weight of beet.	Brix.	Sucrose.	Purity.
	Beets.	*Grams.*	*Degree.*	*Per cent.*	*Per cent.*
Sept. 2	Mean of 50	236	15.0	12.0	79.3
9	200	301	14.8	11.7	76.0
16	200	271	15.8	12.5	78.8
23	200	271	17.0	13.8	80.9
30	200	292	18.7	14.8	77.8
Oct. 7	200	291	19.5	16.0	80.1
14	200	279	19.9	16.0	79.5
21	200	291	19.0	15.0	79.8
28	200	306	19.1	15.3	79.4
Nov. 5	100	322	18.3	14.4	78.7
18	100	329	17.5	13.9	78.1

Desprez Variety.

Sept. 3	Mean of 50	422	12.5	8.8	70.7
10	200	404	13.6	9.6	73.8
17	200	418	14.7	10.7	71.3
24	200	420	15.2	11.4	71.8
Oct. 1	200	448	15.5	12.2	74.0
8	200	401	17.2	13.0	75.0
15	200	384	17.4	13.0	73.1
22	200	385	16.9	12.5	71.8
29	200	390	16.0	11.8	71.1
Nov. 5	100	390	16.3	12.3	72.6
18	50	377	16.2	12.0	73.9

Lemaire Variety.

Sept. 5	Mean of 50	285	12.9	9.1	73.3
12	200	274	14.0	10.8	75.6
19	200	286	15.7	11.8	75.8
26	200	282	17.4	12.9	75.2
Oct. 3	200	275	17.6	13.8	75.4
10	200	288	17.9	14.2	76.4
17	200	260	19.1	14.6	76.9
24	200	270	18.7	14.0	75.1
31	200	256	18.3	13.5	72.5
Nov. 5	200	265	17.6	13.1	74.9
18	100	272	16.9	13.1	77.4

Kleinwanzlebener Elite Variety.

Sept. 6	Mean of 50	269	13.6	10.2	74.9
13	200	267	14.7	11.7	78.0
20	200	280	16.1	12.2	75.6
27	200	291	17.2	13.5	77.6
Oct. 4	200	288	18.0	14.0	77.0
11	200	265	18.8	15.2	81.1
18	200	266	17.5	14.3	78.0
25	200	275	17.4	13.2	74.7
Nov. 1	200	261	17.6	14.0	79.9
5	100	248	17.7	14.2	80.1
18	100	252	17.3	14.0	80.4

Original Kleinwanzlebener Variety.

Date.	No. of beets.	Weight of beet.	Brix.	Sucrose.	Purity.
	Beets.	*Grams.*	*Degree.*	*Per cent.*	*Per cent.*
Sept. 7	Mean of 50	309	14.3	11.0	77.4
14	200	311	15.7	12.7	78.6
21	200	306	18.2	14.3	79.2
28	200	326	18.6	14.7	77.8
Oct. 5	200	316	19.8	15.7	77.7
12	200	320	19.5	16.1	80.2
19	200	314	20.8	15.9	76.3
26	200	301	20.0	16.1	78.9
Nov. 2	100	320	19.4	14.5	75.3
5	100	333	19.2	14.7	76.3
18	100	320	18.2	14.4	79.2

It will be remembered that in the tests made to determine the vitality of the seed of the varieties planted, the Desprez variety showed a germinating power of only 36 per cent. That circumstances affected the history of the variety during the whole season. The crop was not more than two parts in three of a full stand. The development of the organism was irregular, and the beets when mature were extremely coarse, and the sugar content and purity of the juice remained abnormally low. In the season of 1891 the Desprez variety gave the largest weight per acre, with the highest sugar content and purity of juice amongst the six varieties grown. It must thus be considered that the poor results obtained in 1892 with that variety are in a great measure owing to the small degree of vitality of the sample of seed, which sample was the only one of that variety available at the time of planting.

The higher yield per acre of the "Original" Kleinwanzlebener was, in part, owing to the circumstance that the variety was totally exempted from either of the successive insect attacks on one portion of the plat.

The following table gives the weight per acre of beets, the highest sugar content in the juice, with the yield of sugar per acre of each variety:

Variety.	Weight per acre.	Sucrose in juice.	Sugar per acre.	Purity.
	Tons.	*Per cent.*	*Pounds.*	*Per cent.*
Vilmorin's Improved	12.5	15.6	3,900	83.2
Dippe's Kleinwanzlebener	15.0	16.0	4,800	80.9
Desprez	16.8	13.0	4,368	75.0
Lemaire	15.8	14.6	4,614	77.4
Kleinwanzlebener Elite	16.0	15.2	5,120	81.0
Original Kleinwanzlebener	18.6	16.1	5,989	80.2
Means	15.8	15.1	4,890	79.6

A comparison of the seasons of 1891 and 1892 indicates as follows:

Season.	Mean weight of crop of all varieties per acre.	Mean sugar per acre of all varieties.
	Tons.	*Pounds.*
1891	21.7	6,060
1892	15.8	4,800
Mean	18.8	5,430

The mean results of the seasons of 1891 and 1892, obtained upon the Nebraska station, are given in comparison with the mean of results of the same seasons recorded at the Capelle station, France:

Stations.	Beets per acre.	Sugar per acre.
	Tons.	*Pounds.*
Capelle (France)	17.5	5,366
Schuyler (Nebraska)	18.8	5,430

The data from the French station represent the mean condition of the crop in all the experimental fields on November 18, 1891, and November 1, 1892, as stated in the weekly bulletin of that station.

The causes of the smaller yield per acre of the crop in 1892, in comparison with the crop of 1891, upon the Nebraska station, have been already fully considered in parts of the report treating of the climatic conditions and the insect attack.

A series of experiments was made upon small plats, exclusively managed by hard labor, in order to observe the results obtained with a varying number of plants to the acre, or of thick and thin planting.

The following table gives the data recorded:

Date.	Plat.	Number of beets to the acre.	Weight per acre.	Sucrose in juice.	Sugar per acre.
			Tons.	*Per cent.*	*Pounds.*
Oct. 11	A	65,300	13.2	16.6	5,043
11	B	56,000	12.2	17.6	4,296
11	C	49,000	14.3	16.0	4,599
11	D	43,500	11.8	15.9	3,753
11	E	39,200	10.5	16.0	3,344

The only notable characteristics of the plats of the given series are the small yield of beets and the extreme richness in sugar. It is, however, clearly shown that the thick planting gave the largest yield of sugar to the acre.

A plat of 4 square rods was planted, the rows being placed 36 inches apart. Upon one-half of the plat the plants were left 6 inches apart in the row, which gave 29,000 plants. Upon the other half the plants were left 12 inches apart in the row, giving 14,500 plants to the acre.

The results obtained were as follows:

Date.	Plat.	Number of beets per acre.	Weight per acre.	Sucrose in juice.	Sugar per acre.
			Tons.	*Per cent.*	*Pounds.*
Oct. 11..	First half	29,000	10.5	15.0	3,150
11..	Second half	14,500	11.5	12.9	2,967

It is observed that although the second half of the large beets yielded the greater weight per acre, the part of the plat bearing the smaller beets yielded the largest weight of sugar per acre. Moreover, the small beets not only contained 6 per cent more sugar to the acre than the larger beets, the amount of sugar that could be obtained by manufacture from the smaller beets was very much greater because of the greater purity of the juices in comparison with the juices from the large beets.

	Per cent.
Purity of juice of small beets	79.7
Purity of juice of large beets	75.6

During the analytical season of 1891, a series of experiments was made in order to ascertain the loss of weight by evaporation when the beets were exposed, at varying temperatures, to the action of the atmosphere different lengths of time.

In the season of 1892 not only were the experiments upon evaporation and loss of weight continued, those experiments were conducted in order to embrace a study of the problem, viz: The cause of decomposition and loss of sugar in the beet after removal from its normal connection with the soil.

Much attention has been given to the question of the loss of sugar by several distinguished French scientists, and the opinions of those gentlemen upon "the loss of weight and richness of the beet" may be noted as follows: M. Pellet says "All that

is known is that there is a certain loss, and especially an alteration of tissue in the beet." M. Blim says: "The loss is important. But for want of precise information we can not estimate the loss." M. Pagnoul says: "The loss can not spring alone from the sprouting." M. Martin says: "Ventilators in silos increase the respiration and loss of sugar by letting in the oxygen of the air." In opposition to M. Martin, MM. Battut, Beaudet, Desprez, Salo, and Pierrot state that "moving the beets in the silos and letting in the cool air is of utility." The statements that have been quoted are taken from a translation from the Bulletin de l'Association des Chemists de France et de Colonies.

The opinions cited do not touch the question of the primary cause of the loss of weight and sugar in the beet, but are rather statements concerning the chemical changes, which, by the action of a given cause or causes, are observed to take place in the organism of the beet. It is the cause of those chemical changes with which we are concerned, and a knowledge and control of the external conditions which disturb the normal condition of the beet. And under this head there is "no precise information" to enable "us to estimate the loss" of which we speak.

The series of experiments carried out at the station in the season of 1892 was for the purpose of studying the problem stated.

The loss of sugar was studied in association with the loss of weight of the beet, in certain known conditions of temperature of the air and soil. The normal weight of the beet, or its weight when removed from the soil, was the basis of all comparisons and calculations of changes observed to have occurred after its removal from the soil.

On October 3, a square rod of beets of the Vilmorin's Improved variety was gotten up, cleaned, topped, and weighed immediately, and all was completed in fifteen minutes. Before weighing, every particle of soil was removed and the tops were cut off close to the neck, but the neck was not removed. The square rod of beets was weighed at the time of getting up and laid about on the ground again, and reweighed every twenty-four hours for the following four days.

The results of the weighings were as follows:

Date.	Weighings.	Weight of 1 square rod.	Loss of weight for—
		Pounds.	*Per cent.*
Oct. 3	Original weighing	152	
4	Second weighing	132	1 day = 13.2.
5	Third weighing	116	2 days = 23.8.
6	Fourth weighing	103	3 days = 32.4.
7	Fifth weighing	95	4 days = 37.5.

From October 3 to 7 the daily mean temperature of the air was 68°, the mean maximum temperatures for the given days being 90°, which was abnormally high for that period. The rays of the sun were not intercepted by clouds during the four days. Moreover, a wind of high velocity prevailed on each day named. It was observed that under the action of the sun and winds, such as has been described, the beets lost by evaporation no less than 37.5 per cent of their weight.

The sugar content of the beets of the said plat containing the square rod at the time of the original weighing was (mean of 200 beets) 15.1 per cent; the sugar content of the beets upon the last day of weighing (mean of 200 beets) was 17.1 per cent.

It is seen that although the beets lost no less than 37.5 per cent of their weight during the stated period the polariscope reading of the juice of the withered beets was only 2 per cent higher than the reading of the juice of the fresh beets. A great loss of sugar had taken place. The second polariscope reading, instead of being

17.1 per cent, should have been 24.2 per cent had no loss of sugar taken place. The following table shows the proportion of loss:

		Sucrose in juice.	Sugar in beets.
		Per cent.	*Pounds.*
Oct. 3	1 square rod = 152 pounds	15.1	22.95
7	1 square rod = 95 pounds	17.1	16.24
	Difference		6.71

Loss of sugar in four days equals 29.24 per cent.

Even after allowing for the abnormally high temperature recorded during the period of the experiment, the loss of sugar that had taken place was so enormous as to lend doubt to the result notwithstanding the care that had been observed in all the details. The experiment was repeated, and in the following manner: One hundred and fifty beets were gotten up of the Vilmorin's Improved variety and divided into 3 fifties, each of the same weight, 25 pounds. One fifty was analyzed immediately after weighing. Another fifty was left lying on the field, and the third fifty was laid upon a board in the barn, and exposed to the air, but shaded from the sun.

The table following gives the results:

Date of analysis.	Weight of beets.	Loss of weight.	Sucrose in juice.
	Pounds.	*Per cent.*	*Per cent.*
Oct. 8 (fresh beets)	25		16.2
11 (shed beets)	20	20.0	19.6
11 (field beets)	19.5	22.0	18.3

The actual changes in the sugar content of the shed beets and the field beets are shown as follows:

Beets.	Weight of beets.	Sucrose in juice.	Sugar in beets.	Loss of sugar.
	Pounds.	*Per cent.*	*Pounds.*	*Per cent.*
Fresh beets	25.0	16.2	4.05	
Shed beets	20.0	19.6	3.92	3.2
Field beets	19.5	18.3	3.56	12.1

It is seen that the "shed beets," during the seventy-two hours that they lay exposed to the air, but shaded from the sun, lost 20 per cent of their weight and 3.2 per cent of sugar. The "field beets" lost 22 per cent of their weight and 12.1 per cent of sugar. The mean temperature during the three days that the experiment lasted was 58.6°, or 10° less than prevailed in the first experiment, which difference of temperature accounted for the smaller loss of weight and sugar, as shown in the latter experiment. A striking feature in the last experiment is the circumstance that the shed beets lost almost the same proportion of their weight as the field beets, but their loss in sugar was only one-fourth of the loss in the field beets. It is thus indicated that the action of the sun was a chief cause of the greater loss of sugar in the field beets. The latter observation was illustrated by an earlier experiment, which was conducted as follows:

Exactly 210 beets, of the original variety, were gotten up and prepared for analysis. The mean weight of the 210 beets was 326 grams. Before analyzing, 10 beets were selected from the number, and the mean weight of the selected beets was 325 grams, or the mean of the whole. The 10 beets were each wrapped closely in thick

paper and all put in a mail box, which was tightly fastened up and sent to Washington for analysis in the laboratory of the Department of Agriculture. On arrival at the Department laboratory the beets were immediately reweighed and analyzed individually and the results sent to the station at Schuyler.

The following table gives the results:

Date.	Number of beets.	Weight of beets.	Loss of weight.	Laboratory.	Sucrose in juice.	Sugar in beets.
		Grams.	*Per cent.*		*Per cent.*	*Grams.*
Sept. 28	200	326	.....	Schuyler	14.7	47.9
Oct. 2	10	289	12.0	Washington	16.6	47.9

The latter experiment was made merely as a practical test of the condition of the beets after shipment to Washington. The results, however, provide an opportune illustration and support of the circumstances indicated in the preceding experiment, viz, that the beet may lose weight by evaporation, under certain conditions, without a loss of sugar taking place, and that the action of sunlight is a potent factor in causing the decomposition of sugar.

The experiments which have been recorded furnish the most precise data, showing that the decomposition and loss of sugar in the organism of the beet, after its removal from the soil, are caused by heat, and particularly by the action of the sun, and that the rate of decomposition and loss is in proportion to the degree of temperature. The apparently greater loss in direct sunlight is probably no more than can be accounted for by the difference between the temperature in the shade and in the sun, which difference could amount to 30° when the temperature of the air is 90°.

Having observed the action of high temperature upon the organism of the beet and shown that the loss of sugar is in proportion to the degree of temperature, it appeared of particular moment and value to observe the influence of low temperature, and to obtain, if possible, data which might conduct to a mode of storage and preservation of the beets after their removal from the soil that would prevent the great decomposition and loss of sugar which has always been known to occur.

It was decided to store a given number of beets in the ground, the temperature of the soil and the air being recorded, and to place an equal number of beets, in all respects the same as the first lot, in a refrigerator, where the temperature could be maintained approximately at ice temperature. On October 12, when the beets were placed in the earth, the refrigerator had not been delivered, and the cold-storage test could not be run simultaneously with the earth test. It was not material, however, as the conditions of each mode of storage were regulated and recorded rigidly and have the same value. In the earth-storage test the results observed in the instance of six varieties will be given. The beets were gotten up, the tops removed within 1 inch of the neck of the beet, and placed in pits in the earth immediately. The laying in was done by placing a row of beets in a slanting position, with the root on the ground. Between each row a layer of fine soil was placed, and before covering up the beets the soil about them was made moist with water. The covering of soil was 1 foot deep, and the mean temperature of the soil at the time of storing was 63°.

The following table shows the results of storing in earth at the given temperature of the soil (63°) for a mean period of twenty-one days:

Varieties.	Fresh beets.		Stored beets.	
	Date.	Sucrose in juice.	Date.	Sucrose in juice.
		Per cent.		*Per cent.*
Vilmorin's Improved	Oct. 13	15.3	Nov. 3	11.4
Dippe's Kleinwanzlebener	14	16.0	3	13.5
Desprez	15	13.2	4	10.3
Lemaire	17	14.6	4	10.4
Kleinwanzlebener Elite	11	15.2	4	13.6
Original Kleinwanzlebener	12	16.1	4	13.1
Mean		15.1		12.1

The behavior of the beets in earth storage in the seasons of 1891 and 1892 is seen as follows:

Mean of all varieties.	Temperature of soil.	Date.	Sucrose in juice.	Date.	Sucrose in juice.
	°		*Per cent.*		*Per cent.*
Season 1891	51.5	Oct. 15	14.6	Nov. 6	12.6
Season 1892	63.0	15	15.1	4	12.1

It is seen that in the same length of time the beets in 1891, with a soil temperature of 51°, lost 2 per cent in sugar, whilst in 1892, with a soil temperature of 63° the loss was 3 per cent. It must also be considered that the beets had possibly lost a little in weight, in which case the sugar content should appear higher rather than lower. The loss above consequently, was probably somewhat greater than the table indicates.

Storing beets when the soil temperature is above 50° is an undesirable practice. In the uncertain climate of Nebraska it is imperative in order to be safe, as a warm spell may be suddenly followed by a very great fall of the thermometer. On October 20, 1892, the day temperature was 71°, and in the night of October 23 the thermometer went down to 15° (F.). Many beets were frozen too badly to keep.

The experiment conducted in order to establish the results and value of cold storage as a mode of preserving beets after removal from the soil was carried out as follows:

On October 27, 150 beets of the original variety were gotten up, the tops removed to within 1 inch of the neck, washed, and dried. Immediately on being dried the beets were divided into three "fifties" by selecting the largest beet and running down to the smallest and placing a beet by rotation to each of the three lots, thus obtaining a division of the whole into three parts practically identical in weight and quality. After the division each fifty was weighed and the weights recorded. One fifty was immediately analyzed and the sugar content and purity of the juice ascertained. A second fifty was placed in the earth at a depth of 1 foot. These beets were laid in and interlaid with soil, so that they did not touch each other, and before being covered up the soil and beets were made moist by sprinkling with ice water. The temperature of the soil on October 27, when the beets were put in the soil, was 43°, which was further lowered by the ice water. The third fifty was placed in an ice chest or refrigerator. Before being put in the beets were made moist and rolled in earth, in order that the surfaces should be placed as nearly as was possible in normal conditions. Very little earth, however, could be made to adhere to the beets, and the portion that did adhere did not do so in the manner that the soil particles are attached by the root fibers in the natural condition. The temperature of the refrigerator was 41° at the time the beets were put in, and 32° when

they were taken out. The chest was closed and not opened again, except at the top for putting in ice, until November 18, upon which date the beets were removed from the earth and the refrigerator and analyzed.

Before analyzing, the beets were washed, dried, and reweighed. The weights before and after storage were as follows:

Date.	Beets.	Weight of beets before storing.	Date.	Weight of beets after storing.	Loss of weight.
		Pounds.		*Pounds.*	*Per cent.*
Oct. 27	Fresh beets	30.5	Nov. 18	.....	.....
27	Earth beets	30.0	18	30.5	.....
27	Refrigerator beets	30.0	18	28.5	6.0

The analyses of the beets of each fifty are recorded in the following table. The beets were analyzed in tens, five readings being made in the analysis of each lot:

Fresh beets analyzed Oct. 27.			Earth-stored beets analyzed Nov. 18.			Refrigerator beets analyzed Nov. 18.		
Brix.	Sucrose in juice.	Purity.	Brix.	Sucrose in juice.	Purity.	Brix.	Sucrose in juice.	Purity.
Degrees.	*Per cent.*	*Per cent.*	*Degrees.*	*Per cent.*	*Per cent.*	*Degrees.*	*Per cent.*	*Per cent.*
20.2	15.2	75.3	20.0	16.5	82.5	22.5	17.8	79.2
19.6	14.8	75.4	19.9	16.1	81.4	22.0	16.8	76.4
20.5	16.5	80.5	18.6	15.0	80.6	21.8	17.6	80.7
21.1	16.1	76.3	20.5	16.0	78.0	21.0	15.3	73.0
21.8	16.8	77.1	19.8	15.8	79.8	21.0	16.8	80.0
20.6	15.9	76.9	19.7	15.9	80.4	21.6	16.9	77.9

It is seen by the table that the earth-stored beets gave precisely the same sugar reading after twenty-two days as the fresh beets did. The refrigerator beets gave a reading of 1 per cent higher than the fresh beets. It was seen, however, that the refrigerator beets had lost 6 per cent in weight, which would cause the sugar content of the beets to appear 6 per cent greater, providing the actual sugar content had not altered. Now, if 6 per cent be deducted from the polariscope reading, 16.9 per cent, the result is 15.9 per cent, which shows that the sugar content had remained constant. The following table illustrates the actual results:

Date.	Beets.	Weight of beets.	Sucrose in juice.	Sugar in beets.
		Pounds.	*Per cent.*	*Pounds.*
Oct. 27	Fresh beets	30.5	15.9	4.8
Nov. 18	Earth-stored beets	30.5	15.9	4.8
18	Refrigerator beets	28.5	16.9	4.8

It is now possible to give a tabular comparison of the beets which were stored in the earth on October 15 and the beets placed in cold storage, for it must be understood that the temperature of the soil on October 27 was about the same as the temperature of the refrigerator. Also, ice water was added to the soil before it was laid over the beets in the ground, thus securing a still lower temperature, and a proper degree of moisture, which was not possible in the refrigerator. Further, the temperature of the soil after October 27 went gradually down to 35°, thus securing the same temperature as prevailed in the refrigerator with the favorable soil humidity.

It was shown that the earth-stored beets lost no weight, whilst the refrigerator beets lost 6 per cent.

Year.	Beets.	Temperature of the soil.	Date.	Sucrose in juice.	Date.	Sucrose in juice.	Loss of sugar.
		°		*Per cent.*		*Per cent.*	*Per cent.*
1891	Mean of all varieties	51.5	Oct. 15	14.6	Nov. 6	12.6	13.7
1892	do	63.0	Oct. 15	15.1	Nov. 4	12.1	19.9
1892	Cold storage	35.0	Oct. 27	15.9	Nov. 18	15.9	.....

The experiments that have been recorded indicate that the primary cause of the decomposition and loss of sugar in the beet after its removal from the natural connection with the soil is heat. The depreciation in sugar has been shown to be in proportion to the degree of temperature. High temperature causes a rapid and great loss of sugar, whilst at a low and constant temperature the beet can be preserved without any loss in the sugar content.

Cold-storage silos for the preservation of beets for propagation uses are thus to be advised, and particularly as we have no data to refute the reasonable supposition that beets whose organism has undergone the change which is implied by the loss of 20 per cent of sugar—*i. e.*, of one of the constituents—are not in as good a condition to produce seed as though the normal state of the organism had been maintained. Cold storage is equally to be advised in connection with factories as a principle, but the large scale of the operations may prevent its application.

COST OF PRODUCTION.

The cost of production of an acre of beets upon the station field is shown in the following statement:

Cost of production of 1 acre of beets.

1891.				
Oct.	1.	Light plowing		$1.68
	25.	Deep plowing		2.00
	25.	Subsoil plowing		2.00
1892.				
Apr.	28.	Disk harrowing		0.38
	29.	Harrowing (twice, at 17 cents)		0.34
	30.	Rolling		0.17
	30.	Cost of seed (17 pounds, at 15 cents)		2.55
	30.	Drilling seed		0.52
	30.	Rolling		0.17
June	2.	Horse hoeing		0.62
	8–10.	Thinning out (sixty-five hours, at 12½ cents)		8.12
	17.	Hand hoeing amongst plants (fifty hours, at 12½ cents)		6.25
	21.	Horse hoeing		0.62
	27.	Horse hoeing		0.62
	30.	Horse hoeing		0.62
July	7.	Soiling up (twenty-nine hours, at 12½ cents)		3.62
				30.28
Oct.	15.	Getting up beets (by hand)	$13.50	
Oct.	15.	Transport (at 50 cents per ton)	6.00	
Oct.	15.	Rent of land	2.50	
				22.00
				52.28

The items of the above table express the actual cost of production of a given acre of beets, each detail being strictly recorded.

The acre plat selected for the expense control was the particular one most ravaged by the insects, and the yield was the lowest of all the plats.

The weight of beets grown upon the said acre was 12.5 tons. The price per ton obtained for the beets was $4. Therefore, 12.5 tons, at $4, equals $50; cost of production, $52.28; loss, $2.28.

The yield per acre of all the plats grown was 15.8 tons; 15.8 tons, at $4 per ton, equals $63.20; cost of production, $52.28; profit per acre, $10.92.

In considering the cost of production, as shown by the station records, it must be understood that each act of labor was purchased at market prices. Teams were hired at day prices, as were also the men. But accepting $52.28 as the total cost of producing an acre of beets by the best methods of culture, and with the purchase of all labor, that sum can be taken as a basis of calculation by the farmer.

SUMMARY.

In reviewing the records of the work in the season of 1892, we have to observe the following:

The first attempts made for the production of home-grown seed were successful. The yield and quality of the seed were satisfactory; and yet the indications were that, in a season of normal climatic conditions, the results of production would be notably greater.

The cultural season was marked by extreme departures from the normal in respect of climatic conditions. Great drought and high temperature prevailed during the period of maximum growth, which caused a smaller weight of beets per acre than would generally be produced. The dry period and high temperature, however, caused a great richness of sugar in the beet, and a satisfactory yield of sugar to the acre.

An insect attack wrought great ravage in the crop, which reduced very notably the results of production per acre.

The experiments conducted in order to determine the cause of decomposition and loss of sugar in the beets in storage indicated that the primary cause of loss is high temperature, and that a system of cold storage siloing would prevent the loss.

The cost of production per acre of beets was $52.28, and the mean value per acre of all the varieties $63.20, giving a profit of $10.92 per acre.

THE SUGAR-BEET WEB WORM.*

(*Loxostege sticticalis* Linn.)

Order LEPIDOPTERA; Family BOTIDÆ.

The present season has been marked by the appearance in very injurious numbers in parts of Nebraska of a comparatively new enemy to the sugar beet. Our first intimation of its appearance was through the Division of Chemistry of the Department. In connection with its work upon beet sugar this division has established a station at Schuyler, Colfax County, Nebr., and in the middle of July one of the experimental plats at the station was suddenly attacked by a multitude of small caterpillars, which riddled the leaves and occasioned considerable alarm. The fact was at once reported to the Department, and the advice sent, to spray with Paris green

* Advance sheets from report of Entomologist in Annual Report of the Secretary of Agriculture for 1892.

or London purple, was anticipated by an assistant, Mr. C. B. Edson, who was temporarily in charge during the absence of Mr. Walter Maxwell. Later communications from Mr. Maxwell gave us the history of the outbreak and its treatment. It seems that the caterpillars were first noticed on July 22, and when Mr. Maxwell returned on July 25 he found that the visitation was practically over, very few worms being found.

The suddenness of the attack is well indicated by a report which Mr. Edson prepared for Mr. Maxwell. On the morning of July 21 a few holes were observed on the leaves. These were attributed to one of the little leaf beetles. The next morning the farm foreman reported worms on the beets, and examination showed that four plats were more or less infested. In the afternoon one plat was seriously damaged and by night half of its foliage was destroyed, the remaining three plats being also quite seriously damaged. Paris green, Persian insect powder, and white hellebore were applied to a limited number of plants late in the evening. The Paris green was applied in the proportion of one teaspoonful to a gallon of water, and the insect powder and white hellebore were sprinkled as powders by hand over the beet tops. The next morning it was estimated that the Paris green had killed 10 per cent of the worms on the plants to which it had been applied, the Persian insect powder 50 per cent, and the white hellebore none. On account of lack of facilities for distributing the powder on a large scale, the Paris green solution was then sprinkled over plat A in the morning and plat B in the afternoon, 6 pounds of the green being used on 2 acres in the same proportion as in the preliminary experiment of the night before. In the evening the number of worms had apparently increased at least 20 per cent, according to Mr. Edson's statement, except upon plat A, where the Paris green was beginning to operate. On the morning of the 24th the work of the caterpillars on plats A and B was checked, but not stopped. Fifty per cent of the insects were dead upon plat A and less upon plat B. Check plats were still being injured. In the evening a comparatively small number of healthy caterpillars could be found upon the plats treated with Paris green. The next morning on no plant could more than one or two worms be found and many were entirely free. The untreated plats, however, were in much worse condition than the evening before. At noon more Paris green was secured, and one of the untreated plats was sprinkled. July 27 the damage was over.

Mr. Edson in his report calls attention to the extreme activity of the caterpillars and their seemingly incessant work. They chose the top leaves first, but when these were exhausted they worked toward the bottom and eventually ate the stem and foot-stalk of the leaf. When two caterpillars met they would strike viciously at each other with their heads a number of times, and frequently the caterpillar struck the leaf in the same way when unmolested. The efficacy of the Paris green treatment was abundantly proved, but the caterpillars were nearly full grown at the time of the first application and disappeared within a very few days even upon the untreated plants.

Mr. Lawrence Bruner, who has paid particular attention to the insects injurious to the sugar beet, gave some study to this species. From his report it appears that a few of the caterpillars were noticed during the summer of 1891 upon beets growing in the vicinity of Grand Island, Norfolk, and some of the adjoining towns which supply beets for the two factories in Nebraska. The present summer they again made their appearance in these same localities as well as at the Government station at Schuyler. More damage was done at the latter point than at any of the others. After the disappearance of the destructive brood a special inspection of the beet plats at the State Experiment Station at Lincoln resulted in the finding of a number of specimens of the caterpillar, and a little later it was found that at Norfolk, Pipe Center, and Genoa a number of fields had been stripped of their leaves. Other localities where beets were planted for the first season were visited, and while the worms were found they were in much smaller numbers than where beets had been

grown last season. The following facts were gathered by Mr. Bruner from conversation with various persons interested in the cultivation of the beets:

The web worms were most abundant at a distance from sheltered localities bordering groves, and were most numerous upon high ground, hilltops, and slopes rather than upon the flat ground. They were never plentiful on a piece of ground planted to beets for the first time, unless it adjoined one that was cultivated in beets the year before. They were more abundant in the middle of large fields than in small ones, and also in fields that were allowed to run to pigweed (*Amarantus* sp.) the preceding year than in fields where these weeds were kept down. Sandy soil was apparently more favorable to their increase than heavier soil.

LIFE HISTORY.

The life history of the insect has been followed through only a part of the season, but there are certainly two annual generations, and probably three if not four. The July brood is a short-lived one, and but two weeks are required between the maturity of the caterpillars transforming the latter part of July and the appearance of the moths, which couple and soon lay eggs for another generation. The caterpillars of the July brood transform to chrysalids almost immediately after entering the ground. Such, however, was not the case with the caterpillars of the last brood. With this the chrysalis state is normally not assumed for some time, and probably not until the ensuing spring. Cocoons received September 19 from Mr. Edson, at Schuyler, Nebr., contained larvæ which were full grown but somewhat shrunken, and these at the date of writing (December 5) are still in the larval condition. Mr. Bruner, however, in breeding-cage experiments, finds that some of the August brood issue as moths during September and October, and he suggests that it is barely possible that there is another set of caterpillars produced by these stragglers during the fall if the weather permits, but, as already shown, the majority of the August brood remained unchanged until the following spring. From the larvæ of the injurious brood received July 28 and August 2 the moths issued August 6, 8, and 12, while August 15 moths were received from Schuyler together with beet leaves bearing eggs.

The eggs are pale yellow, faintly rugose or indistinctly facetted, slightly polished, somewhat iridescent, almost circular and very flatly convex, and are deposited either singly or in a row of from two to five or more, in the latter case overlapping each other like scales.

The young larvæ are whitish in color with polished black head and piliferous spots. The full-grown larvæ are yellowish white with a broad black mediodorsal stripe, and a still broader subdorsal stripe, the two fine lateral lines being also black. The piliferous warts are pale with a black ring, and the head is yellowish or marbled with black. The hibernating caterpillars make a burrow beneath the surface of the ground, but line it with silk, constructing an inner cocoon which is long, slender, slightly curved, and about three times as long as the larva itself. A somewhat similar cocoon, but a little over half the length, is constructed by the midsummer brood.

This insect is a close ally of the so-called garden web worm, which was treated in the report of the Entomologist in the Annual Report of the U. S. Department of Agriculture for 1885 on pages 265–270. The moth is somewhat darker in general effect; the caterpillar is also darker, and the preponderance in the longitudinal markings shows a decided difference from the normal form of the ordinary garden web worm. It also differs in the apparent absence of the spinning habit in the immature larvæ.

It is one of the insects which, during my early visits to Kansas, and particularly in 1873, was not uncommonly found on *Amarantus blitum*, and was reared to the imago from larvæ upon this plant.

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